REPORT RESUMES

ED 011 959 64 AA 000 078

A PROCEDURAL AND COST ANALYSIS STUDY OF MEDIA IN INSTRUCTIONAL SYSTEMS DEVELOPMENT, PARTS A AND B.

BY- BARSON, JOHN JONES, GARDNER, M.

MICHIGAN ST. UNIV., EAST LANSING

REPORT NUMBER BR-5-0990-PT-A-B PUB DATE 1 SEP 65
REPORT NUMBER NDEA-VIIB-383-PT-A-B
CONTRACT OEC-3-16-030
EDRS PRICE MF-$0.45 HC-$11.16 279P.

DESCRIPTORS- EDUCATIONAL FINANCE, EXPENDITURES, SYSTEMS APPROACH, FACTOR ANALYSIS, *INSTRUCTIONAL INNOVATION, INSTRUCTIONAL MATERIALS, GUIDELINES, *OPERATIONS RESEARCH, MODELS, CLOSED CIRCUIT TELEVISION, COLLEGES, UNIVERSITIES, HIGHER EDUCATION, *MEDIA RESEARCH, *INSTRUCTIONAL TECHNOLOGY, *AUDIOVISUAL AIDS, EAST LANSING

A TWO-PART STUDY WAS CONDUCTED TO IDENTIFY THE FACTORS WHICH CONTRIBUTE TO SUCCESSFUL MEDIA INNOVATION AND INSTRUCTIONAL DEVELOPMENT, AND TO ESTABLISH GUIDELINES TO SERVE OTHERS. IN PART A, THE OPERATION OF MEDIA SUPPORT AGENCIES AT MICHIGAN STATE UNIVERSITY AND THE DEVELOPMENT OF SELECTED COURSES OF STUDY EMPLOYING THE NEWER MEDIA WERE REVIEWED. A HYPOTHETICAL MODEL FOR MEDIA INNOVATION IN COLLEGE COURSES WAS ALSO CONSTRUCTED. IN ADDITION, THE MEANS BY WHICH DEVELOPMENT ACTIVITY COSTS MIGHT BE TRACED WERE STUDIED IN RELATION TO COST EXPERIENCES IN CLOSED-CIRCUIT TELEVISION. IN PART B, A COST ALLOCATION SCHEME SIMILAR TO THAT USED IN INDUSTRY FOR APPORTIONING SERVICE DEPARTMENT COSTS TO PRODUCTION DEPARTMENTS WAS DEVELOPED AND PROPOSED FOR INSTITUTIONS OF HIGHER LEARNING. (GD)

B-383

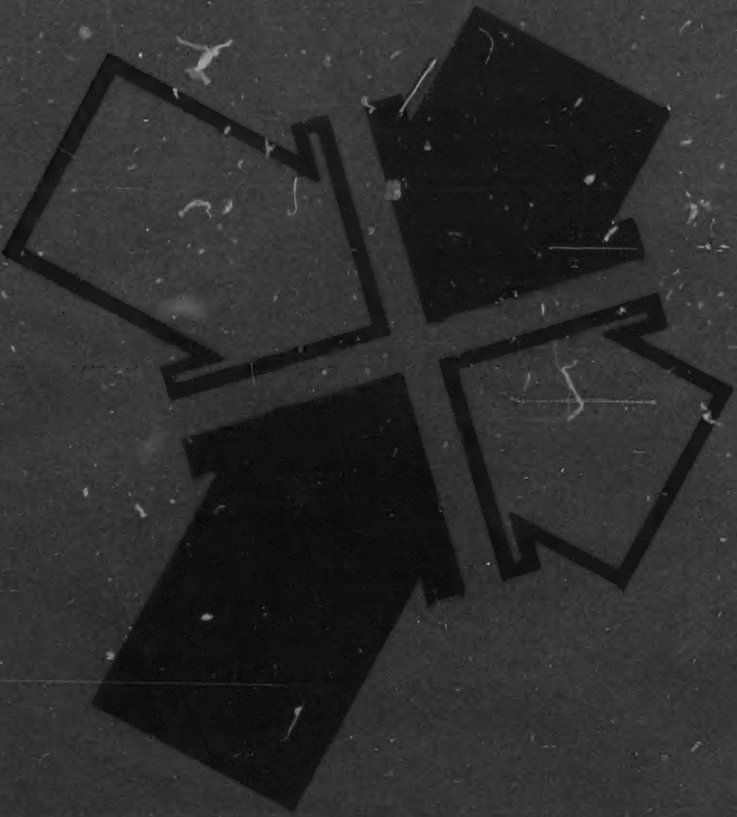
(5-0990)

FINAL REPORT
Grant No. OE-3-16-030

A PROCEDURAL AND COST ANALYSIS STUDY OF MEDIA IN INSTRUCTIONAL SYSTEMS DEVELOPMENT

- PART A -

September 1, 1965



U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Office of Education
Bureau of Research

ED011959

A PROCEDURAL AND COST ANALYSIS STUDY OF MEDIA IN INSTRUCTIONAL SYSTEMS DEVELOPMENT, PARTS A AND B.

- ~~PART A~~ -

OE-3-16-030

Dr. John Barson, Director

September 1, 1965

The research reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

MICHIGAN STATE UNIVERSITY

East Lansing, Michigan

TABLE OF CONTENTS

CHAPTER PAGE

I. Introduction. 1

II. Methods. 4

III. Results. 11

Organizational Support for Instructional Media Innovation. 11

Establishing the Audiovisual Center. 11

Originating Closed-Circuit Television Facilities. 13

Inception of the Educational Development Program. 14

Steps of Media Innovation in Selected Courses of Study. 18

Accounting. 19

Chemistry. 27

Harmony and Aural Harmony. 31

Natural Science. 35

Pharmacotherapeutics. 40

Physiology. 43

Physical Education. 46

Public Speaking. 50

Designing Organization and Development Models for Innovating Newer Media in College-Level Instruction. 54

Administrative Organization Models. 56

Table of Contents Continued

Testing the Instructional Media Innovation Model. 58

IV. Discussion. 65

Role of the Media Center in Instructional Development. 65

Evolving the Instructional Development Model. 69

Examining the Systems Aspects of Instructional Innovation. 70

Devising a Model to Describe Media Innovation in Instructional Development. 73

Refinement of the Development Model. 78

The Role of Specialists in Instructional Development. 79

Conceptualizing the Roles of Specialists. 80

The Evaluation Specialist. 83

The Instructional Specialist. 87

The Media Specialist. 90

Course Development Simulation. 95

Theatre Arts Course Analysis and Media Innovation. . . . 95

Electrical Engineering Course Analysis and Media Innovation. 106

V. Conclusions and Recommendations. 113

Administrative Organization for Media Innovation and Instructional Development. 113

Standard Procedures for Media Innovation and Instructional Development. 114

Table of Contents Continued

The Role of the Specialists in Procedures of Media Innovation and Instructional Development. 114

Recommendations for Further Research and Development. 116

VI. Summary. 117

Bibliography. 125

LIST OF ILLUSTRATIONS

FIGURE PAGE

1. Course Development Interview Form. 5

2. Inputs to Course Development Process. 7

3. General Systems Approach to Education. 8

4. Field Test Design of Instructional Development Systems. . . . 10

5. Summary of Instructional Costs. 24

6. Supporting Instructional Cost Data. 25

7. Staffing Cost Data. 26

8. Flow Chart of Trial Procedures for Analysis and Design of Instructional Systems Employing Instructional Media. 55

9. Course Content-Learning Behavior Matrix. 61

10. Proposed Instructional Development Flowchart. 76

11. Simplified Developmental System Flowchart. 77

12. Input Data Sheet. 84

13. Speech 142 Syllabus. 96

14. Content-Behavior Matrix. 98

15. Design for Relating Content to Behavioral Analysis. 101

16. Content and Instructional Procedures Analysis Form. 102

17. Behavioral Goals of Introduction to Theatre. 103

18. Behavior Analysis. 110

19. Production Format. . .Engineering Short Format Films. 112

20. Procedures for Media Innovation in Instructional Development. 120

21. Course Content-Learning Behavior Matrix. 123

FOREWORD AND ACKNOWLEDGEMENT

The investigation discussed in this report was initiated by a group of Michigan State University faculty members who pioneered in the use of motion picture, television, and the other newer media of communications for instruction. They were interested in identifying the factors which contribute to successful media innovation and instructional development and in establishing guidelines to serve others.

Parallel interest in the College of Business, concerning the costs of the newer media, was incorporated in the study through a concurrent examination of cost-accounting procedures. The two interests were designated Part A, a procedural analysis of media in instructional systems development; and Part B, cost analysis of media.

In Part A investigators reviewed the operation of media support agencies at Michigan State and the development of selected courses of study employing the newer media. They also constructed a hypothetical model for media innovation in college courses.

The staff of Part B studied the means by which development activity costs might be traced. The findings of Part A are presented in this portion of the project final report. Part B study results appear in a separate monograph and annotated bibliography.

Two years of intimately reviewing instructional development efforts at Michigan State and other institutions provide strong evidence that the aspirations and judgments of instructors are critical ingredients in the innovation of teaching practices, especially in light of how little is understood about human learning. These factors were described succinctly by President John Hannah in an address to the Michigan State University Faculty Convocation on January 24, 1964.

> No institution as human as a university can be planned by computer alone, nurtured on statistics, examined by microscope, and weighed finally on precision balances. Its objectives are too much the advancement of the human race. Its successes and failures are too much the products of the human mind and spirit to rule out all emotion and sentiment in evaluating the state of the University.

The Project staff expresses its appreciation to the many persons at Michigan State University, and other institutions, who generously contributed their ideas, time, and services to exploring new approaches to the most critical problem in higher education; the improvement of instruction.

THE STUDY STAFF

PART A - PROCEDURAL ANALYSIS	PART B - COST ANALYSIS
Director: Dr. John Barson	**Director:** Dr. Gardner M. Jones
Associate Director: Dr. Horace C. Hartsell	**Research on Annotated Bibliography:** Dr. T. Harry McKinney

Advisory Committee

Dr. Paul L. Dressel, Director,
Office of Institutional Research
Dr. Charles F. Schuller, Director,
Instructional Media Center
Dr. J. Don Edwards, Chairman,
Department of Accounting and Financial Administration

Staff Specialists

Dr. John M. Gordon, Jr.
Mr. W. Russell Hornbaker

Mr. George Tatu
Mr. Albert Ewald
Mr. Wayne Cunningham
Mrs. Carol Cunningham
Mr. Thomas Notarainni

CHAPTER I: INTRODUCTION

The improvement of instruction in higher education has become a crucial concern in the wake of recent changes visited on universities and colleges. In contrast to the dominant position teaching once occupied in higher education, it now competes with research and other demands for the limited supply of faculty time and other resources.

In the belief that teaching is paramount to all purposes of a college or university, administrators and faculty at Michigan State University have explored the use of the newer media of communication to increase the effectiveness of course instruction. These innovations include the extensive use of motion picture films, closed-circuit television, photographic slides, overhead projection transparencies, programmed instruction, and in some cases even computers.

The vital role newer media plays at Michigan State University was recognized in 1962 by President John Hannah in outlining a seven-point program for the improvement of teaching. The seven tenets officially guide instructional development at Michigan State.

1. Greater responsibility by each student for his own learning.
2. Larger blocks of subject matter.
3. Coordination of Learning and teaching resources, re-definition of the role of faculty members, assistants, aids, and students.
4. Development of new material, aids, and methods.
5. Attention to physical and organizational arrangements which foster learning and encourage independent study.
6. Planning the number, functions, and location of buildings in relation to greater learning.
7. Planning and budgetary procedure to attain the preceding points.

These policy statements underscore the impressive scope and amount of experimentation in course design and media innovation at Michigan State.

Colleges seldom maintain records of the steps taken in successful course innovations. Much that is learned in the change effort remains with the innovators or is lost with the passage of time.

The time and effort losses inherent in repeating the mistakes of predecessors is only one kind of waste. Lost also is the possibility for establishing general instructional development guidelines for higher education. In the two parts of this study investigators examine media innovation in course development at Michigan State University in an attempt to identify key design decisions, (Part A) and their related costs (Part B). This information serves as a basis for proposed models of procedures and administrative organization for implementing the newer media in course instruction.

Administrative sanction and support for introducing media to teaching methods admittedly clears many obstacles for the instructor, but not all. The go-ahead signal confronts him with the complex consideration of what media to employ and how to employ it.

Ideally, the decision to adopt the newer media should be based upon a weighted consideration of the increment in effectiveness and the increment in cost provided by the new in comparison to old or other alternative approaches. Relatively little work has been done to date in establishing guidelines for either of these measurements, despite numerous cases of incorporation of media at the college level. Even less-examined are the steps of development used to achieve the integration of teaching strategies and the use of newer media.

Commonly, adoptions of newer media for instruction result from faculty interest generated by observation of successful media usage in other departments or institutions. Pressed by circumstances and a desire to achieve quick improvements in teaching, academic departments often accept face-value evidence of successful media usage elsewhere as sufficient rationale for its use. Subsequent adoption can vary from using a transparency for emphasizing information the professor wishes students to note to elaborate graphic materials for whole new teaching strategies.

Experience suggests that media applications stand a better chance of succeeding if they are based on expert analysis of the teaching problem and the selection of tested materials. That is, major instructional innovations should be guided by an in-depth analysis of the objectives of the instruction, the nature of the course content, the strategy of teaching, and characteristics of the learners. Few instructors are equipped or trained to conduct these detailed analyses. In addition, the vast number of variables that operate in any teaching situation reduce the correlation of instructional strategies, media of communication, and learning behavior, to an inexact practice at best.

Accordingly, the steps of college course development remain relatively undefined and instructors commonly institute teaching methods and materials with little or no expert guidance and advice.

Despite the relative paucity of cost guidelines and the uncertainty as to what methods guarantee effective teaching, it is inevitable that higher institutions must seek new and better ways to teach. Mounting enrollments and limited resources make the choice of maintaining status quo, or retreating from newer media usage to earlier patterns of instruction, a rare option. The motivation of instructors to innovate with media is important, but only the first step in the change process. Their interest and efforts to change must be backed by viable course development steps and expert assistance in fulfilling their media needs.

Part A of this study report offers a start toward evolving development procedures by offering concrete suggestions for pooling the talents of learning and media specialists in behalf of the instructor.

Reiterating, the overall purpose of this study project was to search out and make available procedure and cost information associated with the use of the newer media of communications in college teaching. Specifically, the objectives were: (1) to do a descriptive analysis and evaluation of instructional development activities at Michigan State University, during the period 1963-1965; (2) to devise methods of measuring costs associated with instructional systems development and principles of sound budgetary planning for the use of educational media in university instruction; (3) to develop hypothetical models of instructional systems development procedures and their relative costs; and (4) to prepare descriptive reports of the above materials for use by other institutions of higher learning concerned with application of technology to instructional programs.

Findings related to objective (2) are presented in a separate report document prepared by Part B investigators.

CHAPTER II. METHODS

The development procedures analyzed in this study were the steps used to introduce instructional media to courses at Michigan State University over the past several years, and instructional design decisions simulated to aid construction of generalizable models for media innovations. The investigators obtained information on these steps or decisions by: (1) interviewing faculty members and media specialists who collaborated in producing visuals, films, and other materials for use in the courses; (2) recording the discussion between faculty and specialists in simulated course development exercises; and (3) reviewing research literature and expert opinion. The data were analyzed to (1) identify the rationale used by course developers in reaching these decisions, (2) determine if any given sequence was optimal, and (3) ascertain the persons best-equipped to play development roles.

The information needed to trace instructional development is not simple to locate or isolate in the complex operation of a major university. Most institutions maintain voluminous records describing financial transactions, but seldom document details of events which entail these expenditures. Investigators sought all available department and university expenditure records which were related to media development projects. While cost records may have served the accountant well, they were not exceptionally useful to the investigators. Their primary use in Part A was to identify media personnel who were involved in instructional development. They offered little as to how instructional innovations started, the effectiveness achieved, and recommendations generated by media usage. Part B investigators comment further on this aspect and make some significant observations on the usefulness of university cost accounting in their report.

Course development activities selected for analysis were identified from the service orders and work request records on file in the Michigan State University Instructional Media Center.

Once it was ascertained that an academic department would cooperate with the inquiry, arrangements were made for a tape-recorded interview with the instructors, administrators, and media personnel involved. Initially, detailed interview guides were developed to guide discussions regarding objectives, student feedback, student-media interaction, instructional branching provisions, and teaching strategies.

After the first few meetings, the interview guide was simplified and shortened. Interviewers found that the categorical jargon of professional education had little meaning for instructors and considerable time was required to translate them into examples of real events and people. The more open-ended questions shown in Figure 1 were clearer to the instructor and produced more meaningful information. Tape recordings of these meetings permitted a review of the discussions and later comparison with other case reports.

Figure 1.

INSTRUCTIONAL SYSTEMS DEVELOPMENT PROJECT
COURSE DEVELOPMENT INTERVIEW FORM

Course (title)__________ Credits__________ Prerequisite__________

College__________ Terms Offered__________

A. Operation

1. Course Schedule__________
2. Classroom Procedure (significant features)__________
3. What revisions have been made in the system (short of re-doing the entire system)?__________
4. Are any class hours released for independent study?_____ Hrs.__________

B. Machines

1. Types__________
2. Operated by__________

C. Personnel

1. How many instructors?__________ Hrs/wk (in days)__________
2. How many assistants?__________ Hrs/wk (in class)__________
3. How many students?__________
4. How many technicians?__________ Hrs/wk (in class)__________

D. Instructional Materials

Type	Self-Study	Used With Instructor	No. Used/ Term	Classroom Facilities

E. Benefits

What are the advantages of the new program?__________

The procedure employed in these interviews required a total of from 8 to 18 hours per course and consisted of the following activities:

1. Establish contact with the personnel and arrange for an interview appointment. (½ hour to one hour/course)
    a. Contact the Dean of the College and the department chairman first to acquaint them with the Project.
    b. Inform persons to be interviewed as to the nature of the Project and the interview.
2. Interview the personnel involved in the development and operation of the instructional system. (2-3 hours/course)
3. Observe the instructional system in action if currently in operation. (4-8 hours/course)
    a. Contact instructors for permission to visit classes.
    b. Observe as many class sessions as necessary to see all the uses of media ascribed to the system.
    c. Make or arrange for still and motion picture records of as many media applications as can be obtained.
4. Prepare a report describing the instructional system and its development. Submit this report to the personnel interviewed for their verification. (2-4 hours/course)
5. Analyze the taped discussion to identify decision makers and decision sequence.

Step 5 in the interview process was aimed at locating common procedures in course development which could be built into the models of process and administrative organization. Figure 2 illustrates the type of information sought from the interview tapes. Occasionally, the interviewer revisited the instructor and/or other professional staff for more information. In the process of reviewing these cases, the investigators found a recurrence of similar decisions, but little similarity in the sequence of decisions.

Figure 2

INSTRUCTIONAL SYSTEMS DEVELOPMENT PROJECT
INPUTS TO THE COURSE DEVELOPMENT PROCESS

DATE____________INTERVIEWER____________RESPONDENT____________

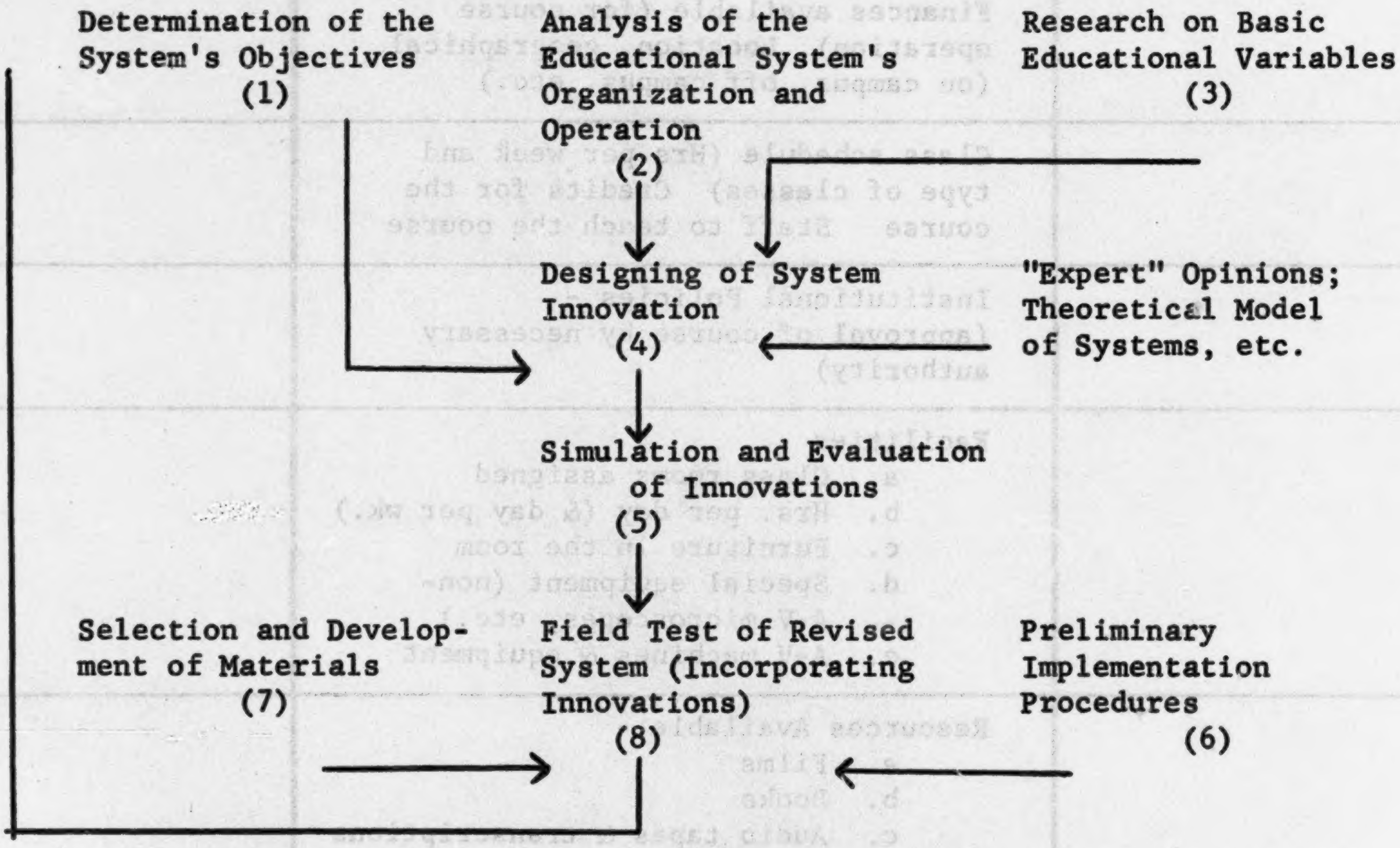
WHEN DETERMINED	INPUTS	DETERMINED BY
	General Goals of the College General Goals of the Department	
	Productivity Loads Resource persons avialable (Eval., A-V, Curric., TV)	
	Set of students (entry Behavior -- course prerequisites) Finances available (for development -- staff time & production) Time schedule (terminal date for development activities)	
	Finances available (for course operation) Location, geographical (on campus, off campus, etc.)	
	Class schedule (Hrs. per week and type of classes) Credits for the course Staff to teach the course	
	Institutional Policies - (approval of course by necessary authority)	
	Facilities a. Class rooms assigned b. Hrs. per day (& day per wk.) c. Furniture in the room d. Special equipment (non-A-V microscopes, etc.) e. A-V machines & equipment	
	Resources Available - a. Films b. Books c. Audio tapes & transcriptions d. Filmstrips e. Slides (2x2, 3-1/4x4, 8x10) f. Supplies (1) ditto paper & masters (2) stencil paper & stencils (3) copy materials and copy machine	

The decision was made to establish some general framework for sorting out the development steps contained in the interview data. This would aid the investigators in better preceiving the development process and, at the same time, provide a start for achieving the other major study goal--the design of instructional media innovation models.

The framework selected was the Systems Approach to Developmental Research proposed by Ryans. A simplified version of the approach is depicted in Figure 3, essentially a procedure designed to improve instruction and administrative organization.

Figure 3

GENERAL SYSTEMS APPROACH TO EDUCATION*


Determination of the System's Objectives (1)
Analysis of the Educational System's Organization and Operation (2)
Research on Basic Educational Variables (3)
Designing of System Innovation (4)
"Expert" Opinions; Theoretical Model of Systems, etc.
Simulation and Evaluation of Innovations (5)
Selection and Development of Materials (7)
Field Test of Revised System (Incorporating Innovations) (8)
Preliminary Implementation Procedures (6)

*A modification of David G. Ryans' Systems Approach to Developmental Research paper presented at the American Educational Research Association Symposium, Chicago, Illinois, 1963.

A significant problem encountered in the analysis was determining the relevance of accumulated information to instructional development and media innovation. This difficulty was somewhat eased by the use of conceptual techniques derived from the province of systems analysts.

Two systems were considered of chief concern to the investigators: (1) activities which comprise classroom teaching--the instructional system (IS); and (2) the planning and preparation of classroom teaching activities--the instructional development system (DS), essentially a system for producing systems. It was the DS or series of DS's which were designed and simulated in the search for a viable model.

In developing a series of hypothetical models of the DS, the investigators were in essence synthetically determining relatively standardized sets of procedures which should most efficiently meet specific instructional objectives. The synthesis of these models followed a thorough analysis of: (1) the successes and failures within the past and present Michigan State University media innovation activities; (2) related situations within the literature; and (3) a consensus of "expert" opinion.

After determining both the logical chain of general decisions, and the appropriate persons to shoulder the responsibilities for these decisions, two courses were selected to test and refine one version of the development model.

Four faculty members from the Department of Speech and the Department of Electrical Engineering were invited to play the instructor's role in the hypothetical model. The two courses involved were introductory courses in theatre arts and electrical engineering.

Specialists for this exercise were drawn from existing staff of the University College Evaluation Services Bureau, the Instructional Media Center, and the Study. Comprehensive tape recordings were made of all encounters between faculty members in the selected academic areas and the specialists specified in the procedures. Their work was guided by the sets of procedures outlined in the model. The simulation was aimed at providing further feedback as to efficiency and effectiveness of the model. The answer sought in assessing the reliability of the DS model, or set of procedures, was whether or not different groups of participants using the same set of procedures can consistently produce an operative Is in an efficient manner.

Several experimental designs were proposed for testing the model. Time and staff limitation permitted the investigators to attempt only one of these designs, Figure 4.

Figure 4

FIELD TEST DESIGN OF INSTRUCTIONAL DEVELOPMENT SYSTEMS (DS)

	Course 1		Course 2	
	Instructor A	Instructor B	Instructor C	Instructor D
Specialist Group I	IS(A)		IS(C)	
Specialist Group II		IS(B)		IS(D)

A certain sum of operating capital was allotted each of the four instructors. Instructors A and C worked with Specialist Group I, following a prescribed set of procedures. Instructors B and D followed the same set of procedures with a different group of Specialists, representing the same areas as Group I. Various comparisons of the "products" IS(A) through (D) were attempted to indicate the comparative efficiency and reliability of the hypothesized model, or developmental system, or set of procedures, or instructional systems developmental activities.

CHAPTER III: RESULTS

The investigation in Part A of this study was concerned with (1) analyzing and evaluating instructional development activities at Michigan State University and (2) developing hypothetical models for incorporating media in instructional systems development. The findings of these analyses are reported in three parts. The first is a brief review of major policies governing the inception and growth of media and instructional development services at Michigan State University. The second part consists of a step-by-step account of decisions involved in introducing media innovations in selected courses of study. The third part is a discussion of hypothetical procedural and organizational models proposed for incorporating media in college teaching.

Organizational Support for Instructional Media Innovation

Presently, the newer media of communications are considered an integral part of many courses having large enrollments, as well as, tools for improving instruction in classes of conventional size. Few departments operate without some reliance on films, televised materials, projected visuals, and other graphics. Instruction in some courses depends heavily on the technical advantages inherent in newer media forms. Generally, the introduction of media into courses is a voluntary decision of faculty committees and individual professors. Technical assistance from personnel in the Audiovisual Center, Closed Circuit Television Department, and various other University specialists is available upon request.

Instructional media support agencies at Michigan State have no jurisdiction over course development policies in Colleges or departments. However, the very nature of media innovation influences changes in teaching methodology. The type of influence exerted on teaching by the design function of University media agencies is similar to that of commercial publishers who produce college texts. Production and implementation of the newer media in a limited way puts the University in the publishing business and subjects it to all the complex demands of such enterprise.

Establishing the Audiovisual Center

The establishment of audiovisual services was guided by the exploratory work of two appointed faculty committees in 1950 and 1951. One committee was organized from the faculty of the Basic College (subsequently replaced by University College), a division of the University charged with providing the first two years of basic education for freshmen and sophomores in all other divisions.

The efforts of this committee overlapped the later work of an all-University committee, chaired by Dr. William H. Combs, Dean of University Services. This group studied the possible centralization of audiovisual service for the whole institution. Up to that time the procurement of audiovisual materials and provisions of equipment was largely the responsibility of individual faculty members and adacemic departments and resulted in some department-centered equipment pools. The work of the University-wide committee covered a three-year period and included a survey of existing materials and equipment (maps, globes, etc.). The committee's recommendations are summarized as follows:

1. A centralized audiovisual service should be established providing a strong on-campus service (projection service, graphics production, and film circulation).

2. A director should be hired to plan and develop the services such a center could feasibly offer, since the committee itself could not agree on specifics. (Dr. Charles F. Schuller, the present director, was appointed to this post in February of 1952.)

3. The underlying purpose of the Audiovisual Center should be the improvement of instruction. (It was felt that the provision of facilities and services would be a means of encouraging the faculty to analyze their whole teaching program and to experiment with new and improved methods.)

On the basis of these guidelines operational plans were laid for an Audiovisual Center, including support and staffing. An early proposal to have each academic department allocate a certain amount of money to be spent in the Center was rejected. Instead, each department was directed to transfer funds out of its supplies and service budget to pay for the charges which the Center billed. This arrangement slowed acceptance and use of audiovisual services, particularly in years of slim department budget appropriations. Additional progress toward the goal of liberalized audiovisual service was achieved in 1965 by an announcement to the faculty that film equipment rentals no longer would be charged to departmental budgets, but would be supported by a general University appropriation. In effect, this permitted "free" use of certain services and materials by any faculty member within reasonable limits. Motion picture film and graphics production were not included in this allowance.

Professional staff members at the Center were chosen primarily on the basis of their knowledge of effective educational practices and secondly on their experience in the media field. This ongoing policy has developed an eschelon of media specialists who can deal on a high level with instructional problems from various disciplines.

Originating Closed-Circuit Television Facilities

The origin of television usage for course instruction can be traced back to the 1951-54 period, during which closed-circuit programming and television broadcasts began on campuses. Studio facilities established in the Electrical Engineering Building were interconnected by cable with the College of Engineering and Auditorium Building. Some instructional presentations were sent via cable to classes meeting at these locations, while others were kinescoped for use on cooperating commercial television stations. These early film recordings of television lessons were the forerunners of course instruction later offered on the University's own television station, WKAR-TV, Channel 57 (now replaced by WMSB, Channel 10). The gradual expansion of closed-circuit television was technically supervised and aided by the Television Department staff, directed by Dr. Armand Hunter. Early decisions were supported by reactions to letters President Hannah sent to a number of University Staff members seeking their opinions on the further development of televised instruction on the campus. Later a television studio was constructed in the College of Veterinary Medicine and by the winter quarter of 1956 was in use to demonstrate animal surgery procedures and other physiological studies. This somewhat space-limited studio was occasionally used by other academic departments as interest in television grew.

The current Closed-Circuit Television offices, studios, and video-tape recording facilities in Erickson Hall were installed under the supervision of Dr. Colby Lewis and J. D. Davis. On July 1, 1962, the responsibility for Closed-Circuit Television was shifted from the Division of Broadcasting to the Provost's Office. This step was taken to more clearly distinguish the purposes of the medium for on-campus instruction and to more effectively coordinate the relationship to teaching. More recently Closed-Circuit Television has been incorporated as a division of the Instructional Media Center (formerly known as the Audiovisual Center).

Closed-Circuit Television is only remotely connected with the television and radio broadcast facilities at Michigan State. Broadcast facilities of television station WMSB and radio station WKAR are intended to aid the University in fulfilling its obligations of service to the community and State as a Land Grant College. Closed-Circuit Television is wholly concerned with instruction for the on-campus student population.

The facilities of Closed-Circuit Television are directly subsidized by the University general funds, and no charges are made to the individual faculty member of departments for production or transmission costs of televised courses.

Inception of the Educational Development Program

The Educational Development Program is a division of the Provost's Office responsible to the faculty and the administration in the continuing work toward improvement of the educational opportunities provided for students. This office helps to coordinate the tremendous academic expertise found on the campus. It helps to facilitate the development of new academic ideas, procedures, and models. It attempts to develop research data for more scientific resolution of problems and issues which previously had to be decided on a prior or intuitive base. It communicates new movements, new breakthroughs, and new innovations from one segment of the University to the other. It attempts also to stimulate faculty thinking about academic and curricular improvement throughout the University.

A recognizable surge in educational development at Michigan State University occurred in January of 1959. At that time President Hannah charged the Committee on the Future of the University with the complete evaluation of Michigan State University. This charge was motivated by a growing concern for expanding enrollments, exploding knowledge and limited resources. The report of the Committee was published in the summer of 1959 and was received with enthusiasm by the faculty. Many of the recommendations of the Committee were brought to fruition. As a result of the report, considerable attention was directed by the faculty to the academic strengths and weaknesses in the University. Individual departments and groups began a tentative scrutiny of their curricula.

A second forward thrust in educational development was made in March, 1961, through the establishment of the "Seven Point Program." This program enunciated a set of academic principles with the purpose of helping the University meet the new demands being made upon it. The "Seven Point Program" seemed to lack the breadth of impact of the report of the Committee on the Future of the University. However, a study of currucular indices indicates that the proposal to evaluate curricula and consider introduction of the seven academic points was generally accepted, endorsed, and implemented by numerous dynamic and energetic faculty groups.

In February of 1963, a third wave of academic development was launched. For the first time the term Educational Development Program (EDP) was introduced. Thirty-one tentative curricular guidelines were distributed for discussion purposes. This program created great faculty concern. Many faculty members expressed fear that a "master design" was being imposed upon the curriculum. These fears were unfounded. Nevertheless, organized study of the guidelines was dropped. Once again, evidence indicates that the proposals had remarkable impact. Major course and curriculum studies were started in most departments of the University. Combinations of the thirty-one guidelines and the seven points were studied in detail. Significantly, most curricular revisions tended to be in line with the seven points and the thirty-one guidelines.

In June of 1963, the University through its committees and councils officially approved three of the guidelines: "Retention of the quarter system," "180 credits minimum for graduation," and the concept of "larger blocks of credit." These three faculty-approved guidelines paved the way for full-scale curricular revision which has now spread throughout the University.

With the establishment of the Educational Development Program in February, 1963, the University requested general education support from the Ford Foundation fund for the Advancement of Education. The original proposal requested a major grant to be used principally for the release of faculty time to study the academic, non-academic, and co-curricular aspects of the University. The Ford Foundation studied the request and suggested that prior to further consideration of the proposal a profile of the University should be developed from which the Foundation might judge the potentiality for success of the proposal. In the spring of 1963, the Ad Hoc Committee for Economic Projections developed the profile. During the summer of 1963, the Educational Policies Committee recast the proposal. Both the profile and the new proposal were submitted to the entire University faculty, were considered and approved by the Academic Council and the Board of Trustees. The new proposal was submitted in November of 1963. The Foundation studied this proposal over the ensuing months. After most careful consideration, the Board of the Ford Foundation decided that it should not make a major educational development grant to a large public university (all previous Ford Foundation grants of this nature had been made to private or church-related institutions). After several months of consideration, the Foundation decided to support the University modestly to initiate an Educational Development Program. The amount of the grant approved on July 24, 1964, was $440,000 to be used in a three-year period to study the curriculum, the learning-teaching process, and the utilization of faculty, financial, and physical resources.

With a modest grant, the University was faced with a series of critical decisions relative to the use of educational development funds. The second proposal submitted in November, 1963, had placed equal emphasis upon the study of the development of the graduate and undergraduate program. The limitation on resources forced the decision that for the present the program would be limited to undergraduate development. This decision was in line with the developing nation-side concern related to the survival of the undergraduate programs. In the fall of 1964, the total on-campus enrollment of the University was 31,459. Of these enrollments, 25,963 were undergraduates and 5,496 were graduates. This vast preponderance of undergraduates, coupled with the deep concern for undergraduate education expressed by President Hannah and the Board of Trustees at the May, 1964, meeting, reinforced this decision.

The most succinct statement of the Educational Development Program objectives was provided as a newspaper release on Friday, July 24, 1964. At this time a story indicating the University's acceptance of the grant from the Ford Foundation was announced.

The statement was as follows:

> The Educational Development Program will be devoted to the development and implementation of a set of educational principles and procedures at Michigan State University which will be developed and approved by the general faculty and which will preserve and improve undergraduate education in the face of increasing enrollments, potentially limited financial resources, a growing shortage of faculty personnel and an explosive increase in the amount and complexity of knowledge.

The purposes of the office of the Director of the Educational Development Program are:

1. To identify major problems in the areas of the curriculum, the learning-teaching process and the utilization of faculty, financial and physical resources.

2. To stimulate and conduct research which will suggest solutions to identified problems.

3. To undertake projects and studies which give promise of improving both the quality and the efficiency of the undergraduate program.

...

4. To support and provide service to groups interested in experimentation with new procedures and methods of learning and teaching.

5. To facilitate implementation of faculty and administration-approved solutions to problems.

6. To identify and communicate progress in research, experimentation, and implementation.

Since the Educational Development Program function is to coordinate, facilitate, communicate, and stimulate educational development, there appears to be little reason for creating an extensive organization. The office of the Educational Development Program does not wish to duplicate any organization, structure, or capability already present in the University. In addition, it wishes to conserve its modest resources for academic development projects. At present, the Educational Development Project consists of a Director, an Assistant Director, and secretaries. Beyond this small core staff, a number of experts from the regular University faculty are supported on a part-time, released-time basis to provide necessary guidance and help in the implementation of faculty-designed projects. In addition, the Educational Development Program is receiving material support from such groups as Institutional Research, Evaluation Services, Closed-circuit Television, and the Audiovisual Center. The Educational Development Program hopes to be able to provide a focal point for at present unstructured capabilities in such areas as programmed learning and computer-assisted instruction. If additional help is needed, it will be placed within the framework of existing structures.

The Educational Development Program functions on a project base. Projects related to undergraduate education and submitted by faculty members, faculty groups, faculty committees, departments, colleges of the administration are supported by the development funds.

Steps of Media Innovation in Selected Courses of Study

The analysis of steps followed in innovating media in courses of study at Michigan State University necessarily depended heavily on the recall of faculty members and media specialists who jointly worked on these tasks. The information obtained from these sources, in some cases, turned out to be too fragmentary to include in this report. The courses reported are described in terms of system operation, results, system development, and costs. Only general chronological development sequences are described since, in most cases, the participants could not verify specific step order. The investigators used the available data to seek some natural order in the development process. Interviewers mainly sought to identify fairly gross aspects of the scope and kind of media innovation that had occured:

1. Subject area?
2. How many class hours per term are involved in the innovation?
3. What facilities were required? (size of room, special type of room).
4. How many students per term received this instruction?
5. During which term did the innovated instruction begin?
6. What changes in technique were employed?
7. What services were required--
   a. During development stages?
   b. During the actual instruction process?
8. Was any budget limitation imposed upon--
   a. Development of the new program?
   b. Operation of the new program?
9. What were the student prerequisites for enrolling for the new course?
10. What was the course organization? (In terms of hours of lecture, lab, discussion and other.)
11. Was the content of the course being changed as well?
12. Were any other persons involved in the process of changing the content? Who were they (in terms of their function or job)?
13. Were any other persons involved in the process of changing the methods of instruction? Who?
14. How many man-hours were involved in developing the new program? How many man-hours for each person involved?
15. What personnel were required in the instruction process under the new program?
16. Did this constitute any change in personnel (from those involved in the course prior to the changes now achieved)?

Information obtained by answers to these questions is presented in the eight case reports which follow.

Course: Accounting 210 and 211
Department of Accounting and Financial Administration
College of Business

Media: CLOSED CIRCUIT TELEVISION WITH TALK-BACK PHONES;
2 x 2 SLIDES

Faculty Members Reporting: Prof. John W. Ruswinckel
Dr. James D. Edwards

INSTRUCTIONAL SYSTEM OPERATION

Accounting 210 and 211 comprise the first two terms of study in fundamentals of accounting. A one-hour lecture is presented each week to a large group of from 250-400 students. This is a live lecture by the professor who makes extensive use of 2 x 2 slides to illustrate the accounting forms and entries. These slides provide a large projected image and are usually presented as a series so that the development of a particular accounting form can be clearly illustrated.

This same group of students is divided into recitation sections of 40-50 students each, which meet for the same hour three times per week. Each of these sections is supervised by a graduate assistant or a senior accounting student but the session is conducted by the lecturer-professor via Closed Circuit Television. With the aid of a talk-back phone system, he conducts a question and answer session with students selected from each section.

Each session consists of reviewing a problem that had been assigned to the students to be worked out prior to the class meeting. Any student in any of the eight sections may be called upon to answer a question of the instructor via the telephone facilities. All of the students in all of the recitation sections that are meeting at this time are able to hear the questions and the student responses and are able to see the professor on the TV monitor. Prior to or following the televised session, the person supervising the recitation section will answer any questions that the students have. Also, office hours are maintained by the professor and the graduate assistants during which the students may have individual conferences.

Other personnel required by this instructional system are the television technicians involved in the CCTV studio. Required are two cameramen, one director, and one video engineer who could also handle the audio controls. In addition, a student of television production usually acts a floor manager and one or two other students may assist at audio control and switching. During the large-group lecture, a graduate assistant operates the slide projector.

Results

1. More uniform instruction occurs than would be the case with several instructors conducting the recitation sessions.
2. All the students are taught by a ranking professor.
3. The use of visuals is simplified.
4. The 2 x 2 slides used in large-group instruction permit more efficient presentation of information than chalkboard presentation. Also, this medium permits the visual presentation of an entire accounting form.
5. The course is more structured, better prepared.
6. There is less sidetracking from irrelevant questions in recitation periods.
7. The professor feels that eight recitation classrooms is the maximum number with which he should interact using the CCTV talk-back system. More sections than this would place too great a limit on the student participation.

INSTRUCTIONAL SYSTEM DEVELOPMENT

Initiation

The Accounting Department in the College of Business was faced with the general problems of increasing numbers of students and a reduction in staff services amounting to two full-time professorial positions. Influenced by reports of successful teaching of accounting via CCTV at the University of Houston and at Pennsylvania State University, the Department Chairman decided to attempt a similar project using the Michigan State University CCTV facilities.

The decision for this development was influenced by an overall University study of objectives and costs and a proposed policy to provide budget support and incentive for departments demonstrating ingenuity in the use of resources.

Procedures

The Department Chairman visited the CCTV facilities at Michigan State University and inquired as to their availability. He then offered the opportunity for a television teaching assignment to a selected staff member. He indicated to this person that department policy was to develop new means for instruction and the opportunity was being offered for him to participate. The staff member accepted the assignment and commenced work.

As a result of the examination of available research at the University of Houston and the other forementioned studies of classroom utilization of TV, the Accounting Department made the following decisions: (1) the presence of a live instructor is required in the TV receiving-recitation classroom; (2) live large-group lectures by the television teacher help him to identify with the student.

In addition to the then-existing facilities of CCTV for student feedback, improved talk-back capabilities were designed and installed on the campus by the Michigan Bell Telephone Company. The purpose of using the talk-back system was to permit instructor evaluation of student understanding during the recitation sessions.

In order to determine the feasibility of this method of instruction, a study was made during the spring quarter of 1959. One half of the course was taught by means of CCTV, as described, and the other one-half was taught without using the medium. No significant difference was detected between the value of experiences for the student. The television professor worked closely with Evaluation Services in developing student attitude tests regarding the televised courses. The results of these showed that student attitudes towards the use of television became more favorable as they had more exposure to it (i.e. later in the course). Seventy-five to seventy-eight per cent of the students accepted the use of television.

Costs

The following analysis of costs was prepared by Part B.

CCTV instructional costs consist of six elements:

1. A pro-rated portion of central originating facilities costs, which attach to courses on an hours-of-usage basis. The pro-ration rate depends upon whether the lectures are live, or playbacks of previously taped lectures.
2. A pro-rated portion of distribution costs, which attach to courses on a student enrollment basis.
3. Permanent faculty time for lecturing and supervision.
4. Supporting personnel (proctors and assistants).
5. Special materials (film clips, graphics, exam materials, etc.).
6. Occupancy costs for viewing rooms.

All of these cost elements are included in the analysis of accounting by CCTV from fall, 1959, through spring, 1964.

Staffing and enrollment records were kept by the department during the five-year period of teaching the first two quarters of the three-term sequence of Principles of Accounting courses. Senior professors were used as lecturers in all three courses. In the CCTV courses, doctoral candidates and later masters' degree candidates, and during some quarters, superior seniors were used as viewing room proctors and graders. Open office hours were held by doctoral students with teaching experience. In the third course, doctoral candidates staffed the recitation sections.

Average annual enrollments were AFA 210, 1154; AFA 211, 907; AFA 212, 641. After TV courses were moved to new quarters in 1961, section sizes in all these courses held quite uniform at about 35 persons per room. Average classroom staffing (salary) costs per enrollment were \$12.92, \$14.67, and \$14.94 for the three courses. Staffing costs were lowest in quarters when hourly-paid accounting seniors served as proctors; staffing costs were highest when senior professors took over one or more recitation sections.

Lecture sizes varied from 147 to 368 for the TV courses, and from 109 to 210 for the non-TV course. Average lecture sizes for the three courses were 251, 222, and 169.

Classroom staffing is only one of the costs, however. Using media such as CCTV, there are associated production and facilities costs. A study which the project staff made of CCTV production costs shows a program originating cost of $43.96 per hour of live telecast. AFA courses use talk-back facilities, which adds a cost of $127.59 per month, or $.74 per enrollment for an average quarter. The third cost element is distribution cost through the campus network and to viewers through sets in viewing rooms. Average distribution cost per classroom for an hour of viewing time is $.40. The distribution costs in a particular quarter depend on how many viewing rooms are in use. A fourth cost is occupancy of classrooms (depreciation, maintenance, and utilities), which amounts to $.63 per room per hour.

In Figure 5 , the average costs per term for each of the three courses are given, with supporting details in Figure 6 .

Comparison with Prior Study

In 1962, Instructor Robert Mogis made a cost analysis of accounting by CCTV for the two courses for the 1961-62 academic year. Costs per student credit hour shown by his study and by the current project are remarkably comparable, considering that many fixed costs were included in the current study and not in the prior one.

Mogis study:	
210-211, TV	$6.41
210-211, Non-TV	4.49
Current study:	
210, TV	$6.59
211, TV	7.40
212, Non-TV	5.15

In considering the figures given here, the reader should bear in mind that almost every costing step required arbitrary assumptions about equipment life, salary levels for personnel categories, allocation of occupancy costs and of studio overheads, and other elements, and many averagings of data.

Recommendations

There is a definite need for special assistance for faculty with regard to advisement of learning theory, production of graphics, evaluation and communications.

Figure 5

SUMMARY OF INSTRUCTIONAL COSTS
PRINCIPLES OF ACCOUNTING COURSES

	210 TV	211 TV	212 Non-TV
Classroom staffing cost, per average quarter	$4,974	$4,430	$3,182
Originating cost, per average quarter	2,022	1,802	-----
Talk-back facility cost, per average quarter	284	223	-----
Distribution cost, per average quarter	129	91	-----
Classroom occupancy cost, per average quarter	203	163	115
TOTAL INSTRUCTIONAL COST, PER AVERAGE QUARTER	$7,612	$6,709	$3,297
Average instructional cost, per student credit hour	$6.59	$7.40	$5.15

Figure 6

SUPPORTING INSTRUCTIONAL COST DATA PRINCIPLES OF ACCOUNTING COURSES

	210 TV	211 TV	212 Non-TV
Quarters of experience included in data	15	11	15
Annual enrollment range	1025-1224	843-918	553-730
Average quarterly enrollment	385	302	213
Average lecture size	251	222	169
Average number of lecture groups	1.53	1.36	1.26
Average classroom staffing cost per enrollment	$12.92	$14.67	$14.94
Average hours of broadcast per quarter	46	41	38 (recitation)
Average originating cost per hour broadcast	$43.96	$43.96	--------
Talk-back facility cost per enrollment, average quarter	$.74	$.74	--------
Average number of viewing rooms used	7	6.3	4.8 (recitation)
Average distribution cost per hour of broadcast	$2.80	$2.21	--------
Depreciation, utilities, and maintenance per class hour ($.63 per room)	$4.41	$3.97	$3.02

Figure 7

STAFFING COST DATA
ACCOUNTING COURSES BY CCTV

	210 TV	211 TV	212 Non-TV
Quarters covered in data	15	11	15
Enrollments	5,772	3,324	3,205
Salary costs*	$74,580	$48,780	$47,886
Cost per enrollment	$12.92	$14.67	$14.94

*Calculated on basis of two hours work outside classroom for each hour in class. Salary rates attributed: Professor, $12.00 per hour; Associate Professor, $10.25 per hour; Assistant Professor, $8.25 per hour; Instructor, $4.00 per hour; Graduate Assistant, $3.33 per hour; and Seniors, $2.00 per hour.

Total Hours for various categories during the quarters covered, as calculated from departmental staffing records were:

	210 TV	211 TV	212 Non-TV
Quarters covered	15	11	15
Professor	2670 hrs.	1680 hrs.	720 hrs.
Associate Professor	----	----	1080 hrs.
Assistant Professor	----	----	150 hrs.
Instructor	----	----	360 hrs.
Half-time Instructor	7200 hrs.	5040 hrs.	6300 hrs.
Graduate Assistant	2340 hrs.	1080 hrs.	90 hrs.
Senior (Acct'g. major)	2970 hrs.	2430 hrs.	---- hrs.

Course: Introductory Chemistry 101 and 102
Department of Chemistry
College of Natural Science

Media: FILMS, 16mm, SOUND (To provide lab data)

Faculty Members Reporting: Dr. Carl H. Brubaker, Jr.
Mr. Layton Maybrey

INSTRUCTIONAL SYSTEM OPERATION

Introductory Chemistry 101 and 102 is a two-course sequence in general chemistry for non-chemistry majors. Students meet for two large group lectures and a three-hour laboratory period each week. Five of the lab sessions each term consist of conventional laboratory-type experiences. On alternate weeks, the students view a filmed experiment and write up the results. There are nine filmed experiments in all. Four lab sections are scheduled to meet at the same time. Two sections meet in separate regular chemistry labs for the conventional lab experience; the other two lab sections are combined and meet in a recitation room where the films are viewed. Only one graduate assistant is in charge of the filmed session, which results in a 25% saving in graduate assistant time.

Results

1. The experiments on film provide a familiarity with advanced experiments which the students could not perform themselves, although the principles are within their ability to grasp.

2. A more varied and interesting experience is provided than that resulting from the more typical cookbook, service course laboratories. Even the "wet" lab experiences were specially designed for this course.

3. An answer is provided to the possible elimination of laboratory from all or part of general chemistry for non-science majors. Due to large increases in enrollment, the cost of additional laboratory facilities has led some institutions to adopt just such measures. The approach taken here has reduced the lab space needed by 50% and the assistant time has been reduced 25%. In one term (fall, 1963) $3000 was saved in graduate assistant's salaries, and it was possible to teach the course in two laboratory rooms instead of four.

4. Experiments are quantitative and are written up by the student. The teachers feel that much greater student interest is aroused by getting numerical results on unknowns and in making things, than in telling what happened when "A" was mixed with "B."

5. Proper use of the films requires a thorough briefing, a first viewing of the film, a discussion, and a second viewing of the film. Data from the film is printed and handed out so that the students are free to concentrate on the filmed events and are not distracted by having to take copious notes.

6. Of the films used for Chemistry 101, and most effective, pedagogically, seems to be the one on atomic spectroscopy, while the best science seems to be contained in the one on heat combustion. The students seem to enjoy the film on crystal structure more than others.

7. Success of the laboratories and films depends on very thorough planning and discussion of instruction with the graduate assistants.

INSTRUCTIONAL SYSTEM DEVELOPMENT

Initiation

The Chemistry Department was faced with the problem of not having enough laboratory space to continue the same instructional program for non-majors that they had been providing. In considering alternative solutions at a departmental staff meeting, Dr. Fred Dutton, a member of the department and Chairman of the Educational Development Project Committee of the College of Natural Science, mentioned the possibility of using films as a substitute for some lab experiences. This was presented as an emergency measure and as a more desirable alternative than eliminating lab entirely.

A curriculum committee in the Chemistry Department had been meeting and discussing the problem. They invited consultants to meet with them, including Dr. Horace Hartsell of the Audiovisual Center. Because of the characteristics of the film medium, it was selected as a possible solution which should be studied further and presented in the form of a proposal.

Procedures

Professors McCarty and Popov, of the Chemistry Department, consulted with Layton Maybrey (Head of Film Production, Audiovisual Center) regarding the production of ten lectures on film. Originally, the thinking was for each lecture to be of forty-five minutes duration. After discussion with Mr. Maybrey and further consideration of certain characteristics of the motion picture medium, it was decided to produce shorter length films that would be an integrated part of the "dry" lab period.

A proposal was made to the Provost for the production of nine films at a cost of $21,000. The proposal was approved and Dr. Carl M. Brubaker was released from other duties for the spring and summer terms of 1963 to represent the Chemistry Department in working with Film Production. During the winter of 1962-63, Dr. Brubaker, Dr. Richard H. Schwendeman, and Dr. Donald A. McQuarrie worked to select the major topics and to develop a course syllabus.

Many discussions between Dr. Brubaker and Mr. Maybrey resulted in a film format consisting of short sequences separated by fade-out and fade-in during which the film can be stopped and discussion can take place. Dr. Brubabker would prepare a script and then three or more conferences with Layton Maybrey would be required in order to refine the script and communicate to the film producer all the points involved.

After filming was completed, answer prints were shown to members of the Chemistry Department. A few technical errors were noted and corrected and the films were approved. Final corrections and the addition of sound to the titles was completed and the first prints were produced for classroom use in the fall of 1963.

Class usage of the films revealed the need for a few further revisions. Also, it was found that the amount of data presented in the films was too much to permit the students to take adequate notes and still see everything that was presented. As a result, handouts were developed which were given to the students. These contained much of the raw data for the experiment and permitted the students to attend closer to the film presentation. Dr. Schwendeman and Dr. McQuarrie worked in planning film and "wet" lab experiments during the first year and refined the procedures involved. Drs. Eick and Bateman supervised the new laboratory experiments and made any necessary revisions.

Costs

The following cost analysis was prepared by Part B.
In addition to the production costs for the nine color films, there was a large investment of time and materials in the Chemistry Department. The costs are summarized as follows:

Chemistry Department:

Approximately 1440 hours of professorial time, 100 hours of instructor time, 1580 hours of assistants' time, and 40 hours of secretarial time	$19,626.40
Chemistry materials, net of re-usable portions	3,498.20
	$23,124.60

Audiovisual Department:

Direct costs of film production*	$24,200.00
Total costs for 139 minutes of color film	$47,324.60
Average cost per minute	$340.

* These figures do not include some AVC staff time for film design and direction, nor AVC overhead and amortization of equipment used.

Recommendations

More time should have been allowed for the project. Instead of the six months lead time provided, a year should have been planned.

The musical background used in some of the films should have been omitted from the actual demonstration part of the films; it proved to be distracting at some points (too loud and on occasion, humorous). There would be no objection to the msuic during the title and trailer portions of the films.

Professional evaluation should be involved and a controlled study conducted in order to evaluate the effectiveness of this approach as compared to using all "wet" labs. Time and space problems did not permit this type of study when the project was affected.

Experimentation with the use of 2 x 2 slides as originally planned should still be tried. The plan was to use some 2 x 2 slides to prepare the student for the film. Time restrictions did not permit this development.

More films should now be made in order to provide a degree of flexibility in the program. One or more additional films would permit one or more of the present lab films to be used in the lecture setting if so desired by the instructors involved during a given term. Also, a selection of nine or ten filmed lab sessions from a possible larger collection would better serve to allow for the desires of the instructors. In a given term, the instructors would have to agree on the particular selection to be used in order to make use of a common examination.

Course: Harmony and Aural Harmony
Department of Music
College of Arts and Letters

Media: PROGRAMMED INSTRUCTION, TEXT AND AUDIO TAPE

Faculty Members Reporting: Dr. Merrell L. Sherburn
Dr. Paul O. Harder

INSTRUCTIONAL SYSTEM OPERATION

The subjects of harmony and aural harmony are taught in separate courses, three terms of Basic Harmony and three of Advanced, three terms of Aural Harmony and three of Advanced Aural Harmony. The basic harmony classes meet three times each week in large group sections, during which lectures are presented. An overhead projector is used during the lectures, and the text materials have been put in programmed form for the first year's work.

Aural Harmony classes meet two times each week, one session per week, in the language lab where key lessons are presented. This forces a certain pace to be maintained in the course. The students also work independently with the rest of the required audio tapes using the recording and playback facilities of the listening room in the music building and the language lab, when it is open to "library" use. The audio programs on the tapes are in linear form. The purpose of the aural programs is to develop ear training, or "music memory," and the ability to take music dictation.

The other part of the Aural Harmony course consists of training in sight singing. This is taught in a regular classroom situation, meeting one hour each week. Tape recording is used in this portion of the course as well. After a mid-term examination in sight singing, administered individually, the students are encouraged to take self-administered sight singing tests using a tape recorder. The test is presented in written form and the student records his vocal response. The student's performance is rated by a graduate assistant who listens to the tape and scores the test by subtracting points for each mistake. This evaluation becomes much more objective than is normally the case in testing for this ability. The student is rated more on his relative response, not on absolute pitch.

In addition to being more objective (there is no opportunity for giving prompts to the student, which can occur inadvertently when such tests are administered live) the grading time is reduced by about one-half due to the fact that explanation time by the teacher would be required in a "live" exam. A check on the operation has revealed no evidence of cheating.

Results

1. When the language lab and tapes were first used for ear training and music dictation, two sections were assigned to test its effectiveness. These student did significantly better than the non-lab students who met in a conventional classroom setting.

2. At first the theory classes met two times per week in sections of 85 students using conventional materials. This did not prove satisfactory.

3. Better results were obtained when they met three times per week (125 per class) and used the programmed text and an overhead projector.

4. A completely independent study plan for lab work (for ear training and dictation) was tried at first. This was not satisfactory because some students did not assume the responsibility of scheduling themselves for lab work.

5. As a result of using the programmed text, exam grades were higher. There were more A's and fewer failures.

INSTRUCTIONAL SYSTEM DEVELOPMENT

Initiation

In 1958 the faculty of the Music Department was concerned over the inability of many students to develop the harmony skills to the desired level. It was found that the cause was generally a failure on the part of the student to practice the skill sufficiently during the ten-week term. At about this same time, President Hannah spoke to the faculty and emphasized the need for new methods of instruction and the assignment of more responsibility to the students. Also, at this time interest was mounting in programmed instruction and in the use of language laboratories.

As a result of all these developments, Dr. Sherburn suggested to the Department Chairman, Dr. Owen Reed, that the use of tape recordings might solve the practical problem of providing more practice without increasing the number of faculty members. Dr. Reed provided the magnetic tape and encouraged Dr. Sherburn to develop the aural programs.

Procedures

Dr. Sherburn was assigned all of the aural harmony sections and was provided with the tape needed. Over a period of four years he has developed some 300 plus tapes. No released time was provided.

The language lab was available during certain hours and its staff was very cooperative in making the facilities available and in helping to keep the tapes in good condition. As indicated earlier, independent use of the lab was tried first but this did not prove satisfactory. The freshmen students needed to have the pace set for them. By pacing the students, a mid-term exam can be employed and this becomes avery useful diagnostic instrument with time left to make up some deficiencies uncovered.

Dr. Sherburn acquired his knowledge of programming techniques by reading the available literature on the topic.

Dr. Harder developed the first programmed text (for Harmony 180) and began using it in the spring term of 1963. Programs for Harmony 181 and 182 were developed during 1964-65. Programs were first used in mimeograph form in order to permit revisions. Frames were first written on cards when Dr. Harder was less certain of the best sequence of the content. The text for Harmony 180 has now been published.

Costs

Costs have been minimal due to the availability of the language lab and the fact that tapes were developed without providing released faculty time. From $300 to $400 was provided each year for tapes, This was obtained from University research funds. For the development of the programmed texts for Harmony, Dr. Harder received funds for secretarial help and printing costs from the Educational Development Program of the University.

Recommendations

1. Some of the aural tapes should be revised and recorded under more professional conditions (i.e., eliminating background noises and in proper acoustical surroundings).

2. Some of the verbal information on the aural tapes could be transferred to printed form which would make the process more efficient (reading is faster than listening).

3. There is need for a more adequate listen-record lab in the music building.

4. The text programs for harmony (theory) could be written with more variety in the type of frame.

5. It would have been better if the text programs could have been developed more slowly, making use of comparative sections and representative students to test the effectiveness of the programs.

6. The tests employed are usually of the constructed response type which means that the testing services of Evaluation Services have not been employed. There is a need to try out some machine-scored tests and to determine the correlation between these and the constructed response type normally used.

Courses: Natural Science 181, 182, and 183
Department of Natural Science
University College

Media: PROGRAMMED INSTRUCTION

Faculty Members Reporting:
Dr. Chester A. Lawson
Dr. Mary A. Burmester
Dr. Clarence L. Schloemer
Dr. Floyd V. Monaghan
Dr. Clarence H. Nelson

INSTRUCTIONAL SYSTEM OPERATION

Natural Science 181, 182, and 183 constitutes a sequence of study that is required of undergraduate students.

The text for each course is authored by members of the department and is published by the Michigan State University Press. Portions of each volume have been written in programmed form. Some of these chapters are programmed in a linear format while others use a modified branching technique. The variation in style is due to the preferences of the authors.

Subject areas which have been programmed are genetics, scientific classification, population genetics, the inheritance of sickle-cell disease, linear equations of their graphs, and laboratory study of the gas laws. Many parts of the texts have not been programmed due both to the time and effort that programming requires and to a desire by the faculty to retain portions of the texts in normal prose form.

Results

1. Some of the subject matter was easier for the students to comprehend as a result of programming the material.
2. Because of the comprehension factor just mentioned, it became possible to add new material to the course. In certain cases this was new and difficult material which would probably not be included if conventional text form were to be used.
3. In an experimental study of achievement gains resulting from the use of programmed materials for one chapter versus using regular text form materials, the results favored the programmed materials when the teachers were new. There was no significant difference when the teachers in both groups were experienced.
4. This same program resulted in smooth laboratory work (fewer problems and less need for interactions with the instructor).

5. The results of a student attitudinal questionnaire administered in the fall of 1963 showed that the students favored the programmed materials. The responses were more favorable by the students in some teachers' classes than in others.

6. Other studies using pre and post tests showed a 70-75% increase in learning. One of the programs showed an increase in only 57%. This was a program that had been tried out with a group of honor students. The dependent variables in this case have not been clearly identified.

7. Repeat students using the programmed materials received noticeably higher grades than repeat students who used only conventional text materials.

8. Many students who did not approve of the programmed materials were, from the nature of their responses, poor students of English and probably had trouble reading the programs. (This was personal reaction by one of the faculty.)

9. Some teachers reported that students were much better prepared for discussion as a result of using the programmed materials.

INSTRUCTIONAL SYSTEM DEVELOPMENT

Initiation

In the late 1950's the department of Natural Science was facing the problems of increased student enrollments, the need for more faculty members, and the restrictions of limited laboratory space.

The department considered numerous possible strategies that might alleviate the problems, including the use of Closed Circuit Television, none of which provided an answer that was satisfactory to the staff. At about this time the work of B. F. Skinner and Norman Crowder in programmed learning attracted the attention of Dr. C. A. Lawson, who was the chairman of the department. The features of programmed learning held promise as a possible solution to some of the problems just mentioned. It was felt that through the use of programmed materials the teacher-student ratio could be increased and the student could be made somewhat more responsible for his own learning.

Procedures

Dr. Lawson encouraged other members of the department to try their hand at programming. As a result, Dr. Alice Burmester programmed a chapter on genetics. Dr. Lawson collaborated on the writing of the program. This was followed by several programs developed by other faculty members over a period of several years.

The procedures used by the faculty when writing the programs varied considerably. Direct professional assistance in terms of programming techniques was not used (with the exception of some advice from Dr. Komoski which is cited in the next paragraph). Individual faculty members examined sample programs and then proceeded to develop their own styles and procedures. In some instances a branching style was used. The reason given in support of branching was that it provided a means of "erasing" the mistakes made by explaining why the student response was incorrect. This was felt to be particularly important when the learning task involved problem solving. Other faculty members favored a linear form in preparing the program, especially when the content was mathematical in nature. A variety of page layouts were tried in attempts to reduce the number of pages required and to simplify the use of the program by reducing the amount of page turning required (on the part of the student).

Various writing techniques were employed. In one case, two faculty members worked as a team. This idea was obtained from Dr. Kenneth Komoski, Director of the Center for Programmed Instruction at Teachers College of Columbia University. Dr. Komoski was a resource person brought to the campus through the efforts of a Learning Resources Committee that existed a few years ago. He also suggested that from three to five representative students be used to try out the program as first written in order to identify difficult frames or gaps that required further information. Rather than employ this technique, the normal procedure of the department was to try a new program with one or more sections of Natural Science students. The program was used in mimeographed form for this try-out period. Difficult portions were revised until an average error rate of 10% or less was achieved.

The team of two writers mentioned above worked in the following manner. After identifying objectives in a detailed manner (both subject matter objectives and behavioral objectives), the content was selected. Then each would write his own version of a given frame and these would be compared. One of the frames or a compromise frame would be adopted. Because of years of teaching experience with this subject matter the writers were able to predict where errors would most likely occur and even the nature of the errors. This facilitated the writing of remedial frames to help "erase" misconceptions that would likely arise. One student is quoted as saying, "This is as good as having a private tutor at your elbow." A study was conducted to see if the use of "scrambled" format yielded superior results over an "unscrambled" one. The results showed no significant difference and the students preferred the "unscrambled" style.

Another writer favored the use of large work sheets in order to sequence the subject matter. He would then write up the detailed materials for frames. (This would be typed and the individual frames cut apart and then pasted up in the desired format.) Individual students were used to try out certain portions of the program and a few corrections were made.

As programs became ready for trial, Dr. Clarence Nelson, who is a member of Evaluation Services and of the Natural Science Department, would assist in any experimental studies that were conducted. He was the person responsible for scoring and analyzing the statistics obtained from the evaluation instruments.

While most of the programs involve only the printed materials in the text, the program on rock classification actually involves a cross media approach since realia in the form of rock samples and visuals in the form of 2 x 2 slides are an important part of the program. (see the case referred to as The Rock Study.)

Costs

A few small grants from University research funds were obtained which helped to cover the costs of materials. These would be the developmental and try-out materials. In some cases the faculty member doing the programming has released time in the spring term, when overall student load for the Natural Science classes is lighter during the spring term. Printing costs are not involved since the students pay for the texts.

Recommendations

1. **Since the writing of programs requires considerably more time than does the writing of conventional text materials, (estimates from different persons interviewed vary from five to twenty times as long) released time should be provided to the faculty member who desires to develop a programmed unit.**
2. **Portions of the program should be tried out with a few representative students as the program is being written.**
3. **Linear programming requires less writing time than does a branching program.**
4. **Where analysis, synthesis, problem solving, or evaluation are the behavioral objectives, a branching program seems more logical; where the objectives are recall, recognition, or manual skill, a linear format with a low error rate would be more desirable.**
5. **When a team approach is used in the writing of a program, one individual should not strongly dominate the other.**
6. **Programs should not be adopted for large scale use until they have been thoroughly tested and all necessary revisions made.**

7. In order to obtain the desired results, the faculty members using the program should favor its use.

8. When other media are to be used as part of the program, the assistance of media specialists should be obtained and the production time schedule that is established should be long enough to permit thorough development of the materials.

Course: Pharmacotherapeutics 552
Department of Pharmacology
College of Veterinary Medicine

Media: CCTV AND OVERHEAD TRANSPARENCIES

Faculty Member Reporting: Dr. Clyde F. Cairy

INSTRUCTIONAL SYSTEM OPERATION

Pharmacotherapeutics 552 is the second in a sequence of two courses assigned for third year students of veterinary medicine; 50 to 60 students are enrolled per term. The class schedule consists of two lectures per week that last for one hour each, a two-hour long laboratory demonstration (which is when CCTV is used), and a four-hour laboratory period. In addition to the use of CCTV in the lab-demonstration period, extensive use is made of the overhead projector during lectures. Also, a talk-back phone is used during the CCTV presentation to (1) question students in order to check their perceptions, and (2) answer questions that students raise.

Results

1. The use of these two media makes the handling of information easier. As a result, more content is presented to the students. (This is the subjective judgment of the instructor.)
2. More kinds of information can be presented, such as close-up views.
3. Less preparation time is required for the telecasts after the TV personnel and the instructor have worked together for several programs.
4. The students respond favorably to the use of TV because it aids their observation of the demonstrations.
5. The TV lab sessions save instructional time since all 60 students can see the demonstration at once. Otherwise, several separate lab sessions would be required.
6. The use of the overhead projector in lectures permits more content to be presented, aids in better sequencing of the content, and helps maintain the attention of the student.
7. Fifteen minutes of TV presentation requires between five and six hours of preparation time, not including the work of CCTV in producing graphics.

8. The faculty in the College of Veterinary Medicine are looking with greater acceptance on the use of the newer media, as evidenced by several college-wide seminars on the topic.

INSTRUCTIONAL SYSTEMS DEVELOPMENT

Initiation

Dr. Cairy has made extensive use of both CCTV and overhead projection in his Pharmacology courses. His use of CCTV began in 1957 and was his own idea. He tried it and became enthused over the benefits derived from its use.

Procedure

When the occasion for TV use arises, Dr. Cairy contacts CCTV and indicates his needs. A few days prior to the presentation, the TV director contacts Dr. Cairy and they go over the intended presentation. Often they will meet in the studio-lab and the professor will demonstrate the lesson to the director.

On the day of the presentation, the director, an engineer, two cameramen and a lighting specialist come to the studio-lab to operate the equipment. Professor Cairy uses a check list for the materials that he will use. In addition to the TV personnel, he is aided by a graduate assistant or two, and sometimes by a student. During the telecast, Dr. Cairy observes a studio monitor and often gives signals or comments to the director in order to present a particular view.

Dr. Cairy produces his own overhead transparencies. His secretary uses a typewriter with large print and a thermofax machine to prepare verbal materials. Charts and diagrams are prepared by Dr. Cairy using acetate sheets and special inks. Central Duplicating Service in the Veterinary College produces some of the materials needed from his copy. The diagrams are usually handdrawn and are the type that he would have formerly put on a chalkboard. His collection of transparencies is added to and corrected each year; thus, the collection has developed over a period of several years.

Costs

CCTV costs are budgeted by the University; no charge is made to the department. Transparency materials are provided by the department. No released time is provided for Dr. Cairy.

Recommendations and Findings

If he had to consider direct payment for CCTV services, Dr. Cairy stated that he might not use the medium as often.

The TV presentation is generally limited to about 15 minutes. The present flexibility of time utilization is highly desirable. If it were required to use a longer block of TV time, unnecessary material might be presented just to fill up the time.

The advantages sought from the media in this case are related to the information handling qualities they possess, rather than as a solution to the problem of large numbers of students.

Course: Introduction to Physiology 240 and 241
Department of Physiology
College of Veterinary Medicine

Media: CCTV (Laboratory Demonstration)

Faculty Member Reporting: Dr. James R. Stiefel

INSTRUCTIONAL SYSTEM OPERATION

These are basic physiology courses offered in consecutive terms, which enroll approximately 220 students each term. The students represent a wide variety of curricula; 50 to 75% of them taking the courses as electives. Classes meet for three large group lectures per week (one hour each) and one laboratory-demonstration period of two hours which is conducted by Closed Circuit Television. There is no laboratory activity other than the television demonstration. The students meet in one large group for this televised session.

Results

1. Demonstrations are better and require less time. Every student has a much better view; sometimes even better than the instructor.
2. More content is covered.
3. Students seem to accept the use of CCTV; however there were a few complaints at first.
4. CCTV is being more and more accepted as a "conventional way" to teach on a large campus.
5. The shift to CCTV has not altered the distribution of students enrolling for these courses.
6. The use of a talk-back phone during the television session will be discontinued. It is impractical to pass the phone around to so large a group. Also, the experience now gained by the professor has resulted in changes which now eliminate most of the questions that formerly were raised in the minds of students as a result of poor communication with the students.

INSTRUCTIONAL SYSTEM DEVELOPMENT

Initiation

Pressures of increasing enrollments and shortages of staff resulted in an agreement between Dr. Stiefel and Dr. Alfred, the Department Chairman, to look into the possible use of CCTV; originally, individual lab experiences were provided for the students. Enrollments demanded more lab space and staff than the University could provide and the problem was presented to the Provost.

Procedures

In the spring of 1962, $1,500 was received from the Office of the Provost to release Dr. Stiefel for one term to plan the television work. He worked according to the following procedures.

First, he went into seclusion and studied all the materials and information employed in the course. This examination caused him to delete a sizeable number of exercises which had little relationship to his objectives. Their inclusion was largely "teaching as I had been taught." He proceeded through a streamlining of the course for television presentation.

He then wrote up the experimental procedures in detail which were to be included in the laboratory experiences of the students. Next, Dr. Stiefel took this write-up and associated equipment to the TV producer and inquired, "Can you show this, or can't you? What must we do to this presentation in order to use it on TV?"

He also spend considerable time viewing the work of professors in other areas on CCTV in order to learn more of the techniques being employed. Then he would plan the TV presentation in cooperation with the TV producer.

Dr. Stiefel was permitted a series of "dry runs" to try the presentation, including the testing of visuals on camera. These presentations take place in a specially equipped laboratory-studio in Giltner Hall. Dr. Stiefel indicated that one of the major problems he had was to explore what TV can and cannot do in relationship to what he wished students to observe. While there are some limitations of TV, these did not necessarily hinder his work. He found that converting the lab work to TV was not hard, since the CCTV facility and personnel were made totally available for his use.

The TV instruction began in the fall of 1962. The plans are to continue the work on TV and for some time it has not been regarded as anything extraordinary or special. He stresses that once a faculty member accepts it as the way of doing things, that it becomes the conventional way of doing it for him.

Costs

$1,500 was provided by the Provost to release Dr. Stiefel for one term; actually, he had to spend more time than this for planning. TV expenses were covered by the resources of CCTV.

Recommendations

It would be advantageous to have a specialist in the College of Veterinary Medicine acquainted with the visual techniques of TV to aid the faculty. This would be more practical than having TV personnel learn Veterinary Medicine.

Time spent in observing others teaching on TV is very worthwhile. It is important to understand the limitations of the medium.

Color TV would be desirable.

Course: Foundations of Physical Education 105
Department of Health, Physical Education and Recreation
College of Education

Media: CLOSED CIRCUIT TELEVISION WITH VIDEOTAPE

Faculty Member Reporting: Miss Jean McIntyre

INSTRUCTIONAL SYSTEM OPERATION

Foundations of Physical Education 105 is a first term course required of freshmen in which the emphasis is on the value of and means of maintaining physical fitness. Classes meet for one and one-half hours, two times each week, with separate sections for men and women. The women were the first to make use of closed circuit television as a medium of instruction. In 1961 there were 1600 women enrolled in 45 sections. These were taught by 17 instructors; each was assigned 3 to 5 TV sections, plus 3 or 4 other physical education classes.

CCTV was used in seventeen of the twenty lessons; the duration of the televised lesson ranged from 15 to 40 minutes. The purpose of the televised presentation is to provide information, motivation, and demonstration of proper body movements involved in performing the skill or exercise that is being studied. The classroom teacher has a teacher's guide which includes an outline of the TV presentation and suggested classroom activities. Some time is spent in class answering questions that the students may ask and in further discussion of the information presented. During the TV presentation, the students may be directed to perform certain activities that are being demonstrated. During these activities the classroom teacher is free to observe and correct the performance of individuals. In addition, the students use a text entitled Movement Fundamentals.

Results

1. All the sections progress uniformly through the course, which permits the use of a departmental midterm exam and final exam; all sections cover the entire content.

2. Greater individual attention by the classroom teacher is possible due to the fact that the demonstration is presented by the TV instructor.

3. Demonstrations are more effective since every student has a front seat and can view the body movements from the most advantageous angle.

4. The in-service training of instructors is simplified and the individual talents of instructors may still be utilized.

5. **Enrollments have grown to 3400 students and 96 sections (fall, 1964) with the same staff doing the instructing. Since the classroom teacher is spared the physical demonstration for each class, the additional class load is not so fatiguing.**

6. **Student reaction is just as favorable as in the former non-TV classes.**

7. **Demonstrations can include equipment that would not be available in every classroom.**

8. **Students rated their television teachers very favorably.**[1]

9. **There was no difference in the attitudes of the students with respect to their ability levels.**[1]

10. **Students indicated a strong preference for a superior television teacher over an average live classroom teacher.**[1]

11. **Student achievement, as measured by the objective portion of a final examination, was the same for the TV experimental group as for the non-TV control group.**[1]

12. **Faculty reaction is favorable to the use of television for women's physical education classes. Those most favorably inclined are the teachers who have instructed via the television.**[1]

INSTRUCTIONAL SYSTEM DEVELOPMENT

Initiation

In 1960-61 the staff was very concerned over the problems of rising enrollments and the limitations of no increase in number of staff and other normal resources. As more sections were being added and more instructors required, there was an increasing problem of attaining anything like uniformity of instruction. In March of 1961 some of the staff heard that the University of Illinois was using television for instruction in some of its physical education classes. May, 1961, a visit was made to Illinois by some of the staff.

---

[1] **Janet A. Wessel, Jean McIntyre, Anna Ganung, and Dorothy Kerth, Teaching University Physical Education by Closed Circuit Television (East Lansing, Michigan: Office of Research and Publications, Michigan State University, 1963).**

After the group returned, discussions were carried on by the staff teaching HPR 105, and the application of CCTV seemed very appropriate since the course curriculum involved a considerable amount of visual demonstration. Mr. J. D. Davis from CCTV at MSU was consulted and the staff decided to request that a program be developed for 105 that would make use of CCTV. Discussions were held with the central administration and permission was granted.

Procedures

During the summer of 1961, Miss McIntyre worked full-time for five weeks reorganizing the course for the use of television. Part of that time she worked with Bill Evans, a producer-director from CCTV. Also, a few other instructors participated in this reorganization.

This task was greatly facilitated by the fact that the course had recently been studied and revised by Dr. Janet A. Wessel of the Department of Health, Physical Education, and Recreation. Hence, a clear statement of goals and objectives and precise content already existed.

After one trial experience in front of a TV camera, the program was put on "live" during the fall of 1961. During this term, Miss McIntyre's class load was reduced from eight classes to four. Also, three other instructors have the demonstrations daily via CCTV. Some time was devoted to practice in the studio. Each of the television teachers instructed twice a day on CCTV.

Close cooperation was required between the classroom teachers and the TV teachers. This was not a difficult problem because there had been a history of regular, cooperative group effort. However, the use of CCTV required even closer cooperation and enhanced this process. Because of the greater uniformity of instruction achieved, it now became possible to have a departmental mid-term and final exam.

On the basis of the experience during 1961, it was felt that a higher quality presentation could be made if the program were put on videotape. Also, that this would conserve the energies of the staff and increase the flexibility of the program. Therefore, in the summer of 1962, the TV lessons were put on videotape. During the winter term of 1963, two retakes were made and some final editing took place. Also, teacher's guides were developed for use by the classroom instructors.

Costs

The released time of Miss McIntyre during the summers of 1961 and 1962 was the responsibility of the department. CCTV furnished the videotapes, its staff, and facilities.

Recommendations

1. The TV lesson should have built into it the provision for the classroom instructor to make whatever unique contribution lies within his capability.

2. Provision must be made for individual and group differences.

3. Special visual aids are required for CCTV; those ordinarily used for the classroom are often not suitable.

4. Audiovisual materials can contribute to physical education instruction and CCTV favors their use. Gymnasium settings discourage the use of audiovisual materials (of certain types, particularly projected materials that require room darkening).

5. The tapes should be re-done as they are wearing out. The experiences of the past two years would help to produce tapes of better quality. More time should be allowed for their production.

6. The TV lesson format should be changed to one of presenting information first, then have an "applications" section on the tape. Following this, the classroom teacher would take charge. When a department decides to try CCTV, the lessons should be done "live" at first, rather than recording them on videotape, in order for the instructor to become thoroughly acquainted with TV studio procedures.

Course: Public Speaking 101
Department of Speech
College of Communication Arts

Media: CCTV

Faculty Member Reporting: Dr. David Ralph

INSTRUCTIONAL SYSTEM OPERATION

Public Speaking 101 is a basic course covering principles and practices in effective speaking both in formal and informal situations. Students receive one hour of lecture per week by means of CCTV (videotape). In addition, they meet in groups of about 23 for three, one-hour sessions or for two one-and-one-half hour sessions per week during which speeches are presented by the students for faculty or for peer group evaluation. Two such recitation and practice groups are scheduled for the same hour and are under the supervision of one instructor. The instructor spends a week with one group and then switches to the other for the next week. He continues to alternate between the groups on this weekly basis. Meanwhile, the students in the group that is unsupervised interact with their peers for evaluation of their speech work.

The televised lecture by Dr. David Ralph, the course chairman, is repeated one or two times during the day for scheduling reasons. The lecture is received in several classrooms which are equipped with TV monitors. Approximately 50 students are assigned to each lecture classroom and a faculty member monitors the session. A total of from 500 to 540 students are enrolled in the course each term. Printed materials, which reproduce the visuals used on the TV, are distributed to the students so that note-taking is simplified. The TV receivers are checked, turned on, and maintained by CCTV (the distribution cables are installed and maintained by Bell Telephone). During the playing of the videotape an assistant engineer is required to operate the video recorder. However, this duty need not require all of his attention.

Results

1. Class attendance has remained at the same ratio as it was before the use of CCTV.
2. The TV lecture presented by videotape permits the same information to be presented to all lecture groups.
3. Departmental examinations on speech principles have greater validity since all students were presented the same information in the lectures.

4. **There is improved communication among faculty members regarding course content, goals, and objectives.**

5. **Difficulty was encountered in translating to the TV screen the characteristics of the large graphic illustration aids used by speakers.**

6. **There has been improvement in the statement of goals and objectives for the speech course.**

7. **Research conducted to date has indicated no significant differences in test scores between students receiving TV lectures and those receiving live lectures. Also, no significant differences could be detected in terms of speaking ability improvement on the part of the students, upon their attendance, or upon their attitudes.**

INSTRUCTIONAL SYSTEMS DEVELOPMENT

Initiation

At the direction of the head of the Speech Department, a committee was established for planning Speech 101. Included in this group were persons in speech and theatre. The modification in instruction was intended to take advantage of three developments:

1. The basic University College speech experience was abolished with the reorganization in the University undergraduate program, i.e., Communication Skills became American Thought and Language, a required sequence of basic college courses for all undergraduates. Speech per se is not a part of the content of these courses.

2. General dissatisfaction within the Speech Department with what amounted to 32 different speech courses, all entitled Beginning Speech, taught by different instructors, and using different texts.

3. A doctoral program in Speech was instituted, which resulted in the availability of a relatively large number of graduate assistants for use in the instructional program.

Procedures

The first large-group lectures were delivered on the auditorium stage and later on CCTV by the professors. When videotape was made available, a switch was made to TV recorded lectures for purposes of experimentation and in order to standardize the teaching received by morning and afternoon groups.

The faculty member on TV worked closely with a producer at the CCTV studio in recording four lectures during a holiday period. The other six tapes were made while the professor was lecturing via CCTV to actual student groups. This was due to an attempt to measure the different effects that studio work without an audience and studio work with an audience would have on the mode of instruction. No significant difference was noted in the mode of presentation by the professor.

Experimentation was conducted with the graphic materials. Difficulty was encountered in reading the content of such items as flannel boards when used on the screen simultaneously with the lecturer himself.

The ten videotapes that have been produced were designed to represent the logical, psychological, and ethical material involved in speech making.

Costs

Funds for producing the videotape portion of the course were obtained through the Provost's Office and from the resources of CCTV.

Recommendations

The tapes should be remade using better visuals, if and when funds are available.

An evaluation specialist should be a part of the course planning from the very beginning so that better evaluation studies would be incorporated into the course development.

Equipment and facilities should be provided so that students' speeches could be audiotaped and/or videotaped for use in self-evaluation by the students.

Designing Organization and Development Models for Innovating Newer Media in College-Level Instruction

The construction of models for media innovation was guided by information gained from observations of instructional development cases described earlier in this report and the investigators' experiences in simulating innovation of new media in two selected subject areas; Theatre Arts and Electrical Engineering. This portion of the report describes (1) hypothetical models of administrative organization, (2) a model (flow chart) of instructional development procedures, and (3) a brief review of the trials and rationale which support these models. A more detailed discussion of the simulation of instructional development procedures appears in the next chapter.

The investigators believed that media innovation in instructional development should pivot about the teaching strategy decisions of the instructor and the technical advice and assistance of the media specialist or audiovisual consultant, whichever term is preferred.

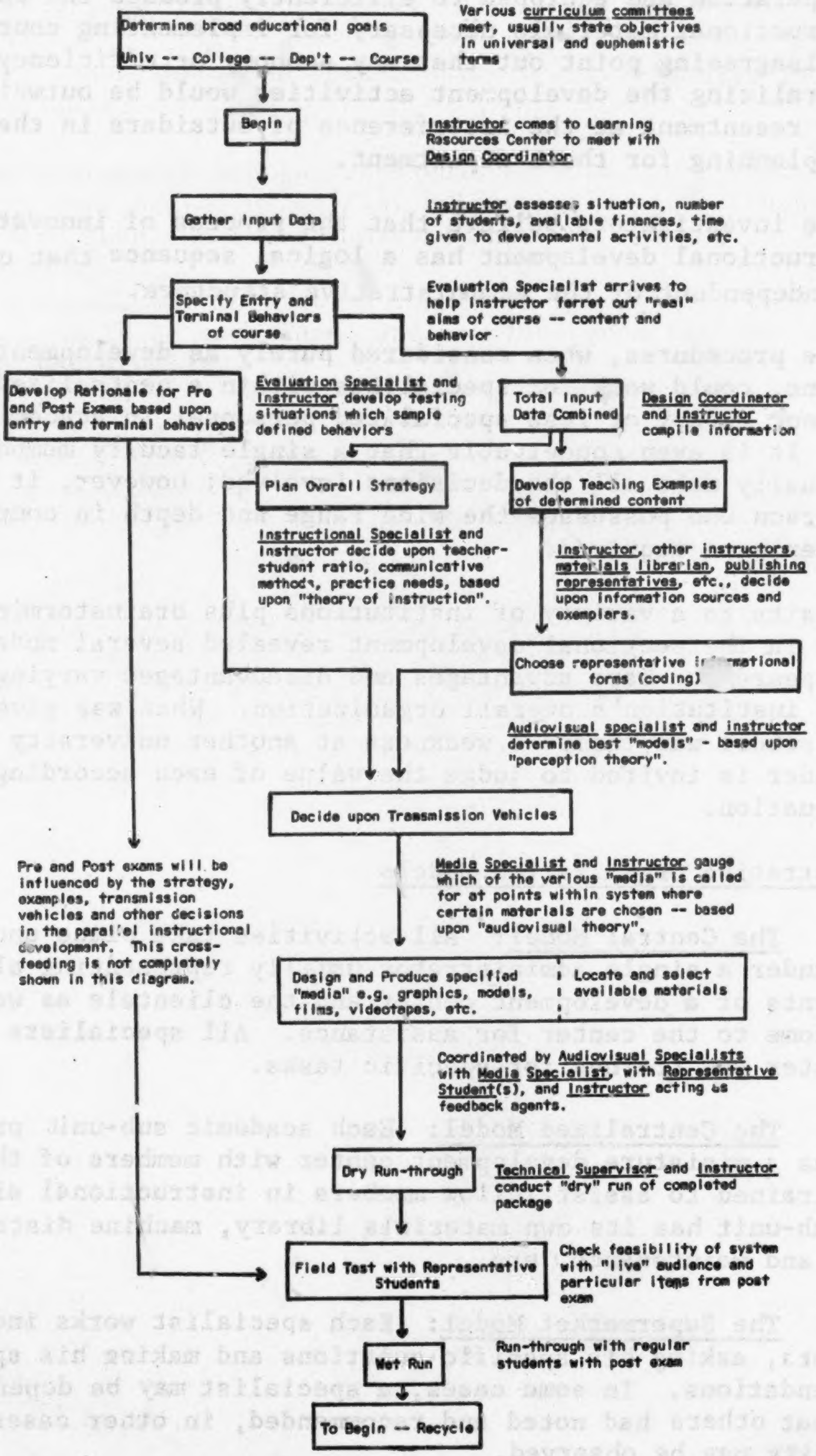
The investigators' first inclination for devising hypothetical models was to evolve a set of workable administrative procedures for simplifying transactions between faculty members and media specialists. From this standpoint, they devised a whole series of what might be termed administrative models of instructional systems development. However, they were keenly aware that these models merely aid in making the relationship among developers compatible and that something more insightful in the way of models was needed if the decisions for teaching methods and instructional materials production were to reflect principles of learning. They sought to fulfill this requirement by proposing a sequence of questions, essentially a flow chart of decisions required of the instructor as he progressed from his stated goals for the learner to his choice of teaching strategy and the subsequent procurement of instructional materials. This process is schematically depicted in Figure 8.

Both administrative practicability and learner theory were taken into consideration in proposing the participants and decisions of the developmental process. The simulation experience in Theatre Arts and Electrical Engineering courses provided an excellent opportunity to make some preliminary observations on the effectiveness of hypothesized procedures and pointed out the gaps in our knowledge of the instructional development process models and administrative procedures when stated in concrete terms; i.e., faculty, facilities, and persons involved.

Figure 8

A FLOW CHART OF TRIAL PROCEDURES FOR ANALYSIS AND DESIGN OF INSTRUCTIONAL SYSTEMS EMPLOYING INSTRUCTIONAL MEDIA

The following flow chart represents a hypothetical elaboration of the System Analysis, Design and Development phases of the "System Approach to Education Planning" (Ryans, 1964). Important: For purposes of simplicity. communication feedback loops are not illustrated in this flow chart.



Determine broad educational goals
Univ -- College -- Dep't -- Course
Various curriculum committees meet, usually state objectives in universal and euphemistic terms
Begin
Instructor comes to Learning Resources Center to meet with Design Coordinator
Gather Input Data
Instructor assesses situation, number of students, available finances, time given to developmental activities, etc.
Specify Entry and Terminal Behaviors of course
Evaluation Specialist arrives to help instructor ferret out "real" aims of course -- content and behavior
Develop Rationale for Pre and Post Exams based upon entry and terminal behaviors
Evaluation Specialist and Instructor develop testing situations which sample defined behaviors
Total Input Data Combined
Design Coordinator and Instructor compile information
Plan Overall Strategy
Develop Teaching Examples of determined content
Instructional Specialist and Instructor decide upon teacher-student ratio, communicative methods, practice needs, based upon "theory of instruction".
Instructor, other instructors, materials librarian, publishing representatives, etc., decide upon information sources and exemplars.
Choose representative informational forms (coding)
Audiovisual specialist and instructor determine best "models" - based upon "perception theory".
Decide upon Transmission Vehicles
Pre and Post exams will be influenced by the strategy, examples, transmission vehicles and other decisions in the parallel instructional development. This cross-feeding is not completely shown in this diagram.
Media Specialist and Instructor gauge which of the various "media" is called for at points within system where certain materials are chosen -- based upon "audiovisual theory".
Design and Produce specified "media" e.g. graphics, models, films, videotapes, etc.
Locate and select available materials
Coordinated by Audiovisual Specialists with Media Specialist, with Representative Student(s), and Instructor acting as feedback agents.
Dry Run-through
Technical Supervisor and Instructor conduct "dry" run of completed package
Field Test with Representative Students
Check feasibility of system with "live" audience and particular items from post exam
Wet Run
Run-through with regular students with post exam
To Begin -- Recycle

The decision on where to best locate these operations is complicated by a difference of opinion observed among authorities at Michigan State University and other institutions visited. Some proposed that instructional systems can best be developed within a centralized agency staffed by experts closely allied to a newer media operation and equipped to efficiently produce the whole range of instructional materials necessary for implementing course changes. Those disagreeing point out that any economy or efficiency obtained by centralizing the development activities would be outweighed by faculty resentment at the interference of outsiders in the instructional planning for their department.

The investigators believe that the process of innovating media in instructional development has a logical sequence that can be considered independent of the administrative structure.

The procedures, when considered purely as developmental functions, could work for specialists within a centralized department agency or less specialized personnel in academic departments. It is even conceivable that a single faculty member could individually make all the decisions involved; however, it is a rare person who possesses the wide range and depth in competencies and experience required.

Visits to a variety of institutions plus brainstorming with experts in instructional development revealed several models. Each appeared to have advantages and disadvantages varying primarily with an institution's overall organization. What was given as a strength at one school was termed a weakness at another university setting. The reader is invited to judge the value of each according to his own situation.

Administrative Organization Models

A. The Central Model: All activities take place under one roof--under a single administrator usually representing all the components of a development center and the clientele as well. The users come to the center for assistance. All specialists within the center are trained for specific tasks.

B. The Centralized Model: Each academic sub-unit or department has a miniature development center with members of the sub-unit being trained to assist fellow members in instructional situations. Each sub-unit has its own materials library, machine distribution and maintenance, etc.

C. The Supermarket Model: Each specialist works independently of others, asking his specific questions and making his specific recommendations. In some cases, a specialist may be dependent upon what others had noted and recommended, in other cases, no continuity may be observed.

D. The Togetherness or Conference Model: All specialists share in the analysis of instruction and offer recommendations at one or a series of meetings with the professor.

E. The Observation Model: Specialists critique the professor's actual teaching performance, offering media suggestions. His teaching may be videotaped so the professor could also watch.

F. The Go-It-Alone Model: One specialist is assigned to one instructor. Together they seek out problems and solutions without consulting other specialists, if there are any.

G. The In-Service Model: Specialists train professors to solve their own instructional problems by educating them as to advantages, operation, and maintenance of devices - useful in large school systems or small colleges.

H. The Distribution-Library Method: No consultation services are made available to faculty, only the devices, materials, and some maintenance and procurement services; an approach currently found in elementary and secondary schools.

The choice of any of these gross models is most often determined by the size, money, and policy factors within a school setting.

The investigators next sought to more clearly define the second portion of their stated objectives, that dealing with the development procedures. Through visits and observations they reached a basic conclusion concerning the nature of instructional problems, that regardless of the setting, the decisions made were equivalent in kind and sequence. The same questions appeared to be asked, the same information sought, and the same alternative decisions offered. The great need for clarity appeared to be in the process rather than the setting. Thus they centered their major efforts on analyzing the common sequence of decisions that seem to be prevalent in all settings, and then developed a standard operating procedure for weaving one's way through this maze of information, decisions, and actions.

The plan was to seek out patterns within cases of past and on-going occasions of media utilization on the MSU campus. But the past had fled from the participant's recollection and the present cases were moving much too slow and haphazard to keep the close touch needed for the planned analysis. Certain very general conclusions were drawn, many negative because of the lack of any systematic attack upon the problems. In most media innovation cases the Audiovisual Center was fully occupied with production decisions. Media specialists were not able to undertake the direction of in-depth decision-analysis that might have been desirable. Other cases were of the "quick-fix" variety, such that little clear teaching strategy rationale was obvious for most of the decisions made. Nothing of the nature of the pre-planning, now fairly well-known in the area of programmed instruction, was in evidence except for a few cases.

Testing the Instructional Media Innovation Model

The solution to the investigator's dilemma was to simulate the procedures of a "developmental system" and "field test" it with professors that had made earlier overtures to the Center and were willing to join in the trials. Using this approach, the study staff would have much greater control over the setting and be able to gather first-hand data from the proceedings, including the participants' feelings concerning the operation. The immediate and obvious experimental error was that by "meddling" in the operation, it would then not be natural and the observations would be less generalizable. The only recourse was to be keenly aware of this fact and be especially sensitive to the events, recording faithfully all the data manageable.

At the outset there seemed to be three major factors that would affect the decision-making pattern employed in course preparation--the professor, the specialists, and the subject matter. It also seemed that the proposed hypothetical approach to the instructional development might be in need of variation due to the possible motivation of these three factors. The study staff was pleasantly surprised by some of the candid interaction that resulted. The situation presented itself in that they were able to assess a number of subtle outcomes from these interactions. Two professors from each of two quite different subject matter areas, Theatre Arts and Electrical Engineering, were willing to participate in the test. The study team marshalled together two sets of specialists, randomly paired them off with professors over subject matter area illustrated in the "factorial design" in Figure 4, page 10.

This design was intended to yield an assessment of reliability of combinations of instructors and specialists over course content. The information sought in the design is whether instructional development A equals the effectiveness and efficiency of instructional development B, also whether instructional development C and instructional development D were comparable.

This experimental design was not carried out to its ultimate conclusion for reasons discussed in what follows. However, the problems encountered in the simulation attempt generated a number of definitive questions and hypotheses. The investigators regard these outcomes as valuable to understanding instructional development procedures and the potential role of specialists in the process as any data thus far available in the liturature.

Determining the specialists roles turned out to be in itself a major undertaking. For it brought to a head the questions of who is a specialist, and "What makes him special?" The direct attack was to interview various campus personnel representing areas involved with the instructional process, hoping to draw together a team that could function separately and as a whole when needed. Staff members talked with evaluation, communication, curriculum, television, and audiovisual specialists; as well as psychologists, administrators, and public relations experts. As one might expect, they received a wide range of replies; some to the point, and others frankly ambiguous. Beleaguered and bewildered by the mass of verbiage, they struck out on a new track, that of assessing the general sequence of decisions that seemed to be prevalent while "developing a course" and then selecting those "specialists" who seemed best qualified to make suggestions as to the forming and weighing of decision alternatives.

The first task, that of specifying the decision sequence, required a tremendous analytic attack, one which still is being pursued. Undaunted and armed with a "first-level sequence" they selected evaluation (test and measurements) specialists, strategists (educational psychologists specializing in instruction-learning), media (audiovisual consultants), materials production, and materials retrieval specialists already available for service on the instructional team. The study staff could not find persons specializing in instructional strategy. In the simulation these decisions were left to the media specialists. The lack of trained personnel in this area was apparent at many of the development sessions. This lack forces media specialists at various institutions daily to play a consultation role for which they have not been adequately trained. The same observation was made in many instances regarding the decisions required of the evaluation specialist. The conclusion is that either new personnel should be trained to fill this void or audiovisual training programs should broaden their scope to encompass the entire group of instructional decisions.

Another immediate and continuing problem was one of a common terminology that all the participants could use to communicate their ideas. Each of the specialists had their own "lingo" which was many times incomprehensible to even the other specialists. The instructors had none other than that of "teaching the course."

A novel "matrix" (Figure 9, page 61) for content and behavioral analysis was developed as an initial step toward this common taxonomy. This matrix is discussed at length in the next chapter. Unfortunately, neither the evaluation specialists nor the instructors could be given enough orientation to become familiar with the "matrix" to give it a thorough test.

A communications problem arose with regard to the various media terms. At one point an instructor asked for a basic audiovisual text to study before the next meeting. Each of the four cases continually demonstrated the great need for both a language of instructional development and the need for the participants' familiarity with that language prior to decision-making.

A further point of interest brought out by the attempt to "fill in" the matrix was the unexpected inability of the instructors to separate the concepts and principles from the teaching examples of these abstractions. The specialists were asking for the "structure of the discipline." When all the instructors wavered at this point, the project staff tried to analyze their own particular areas to get a personal assessment of the difficulty of the task. It was, to say the least, a mammoth job, quite a revelation for them, as well as the instructors.

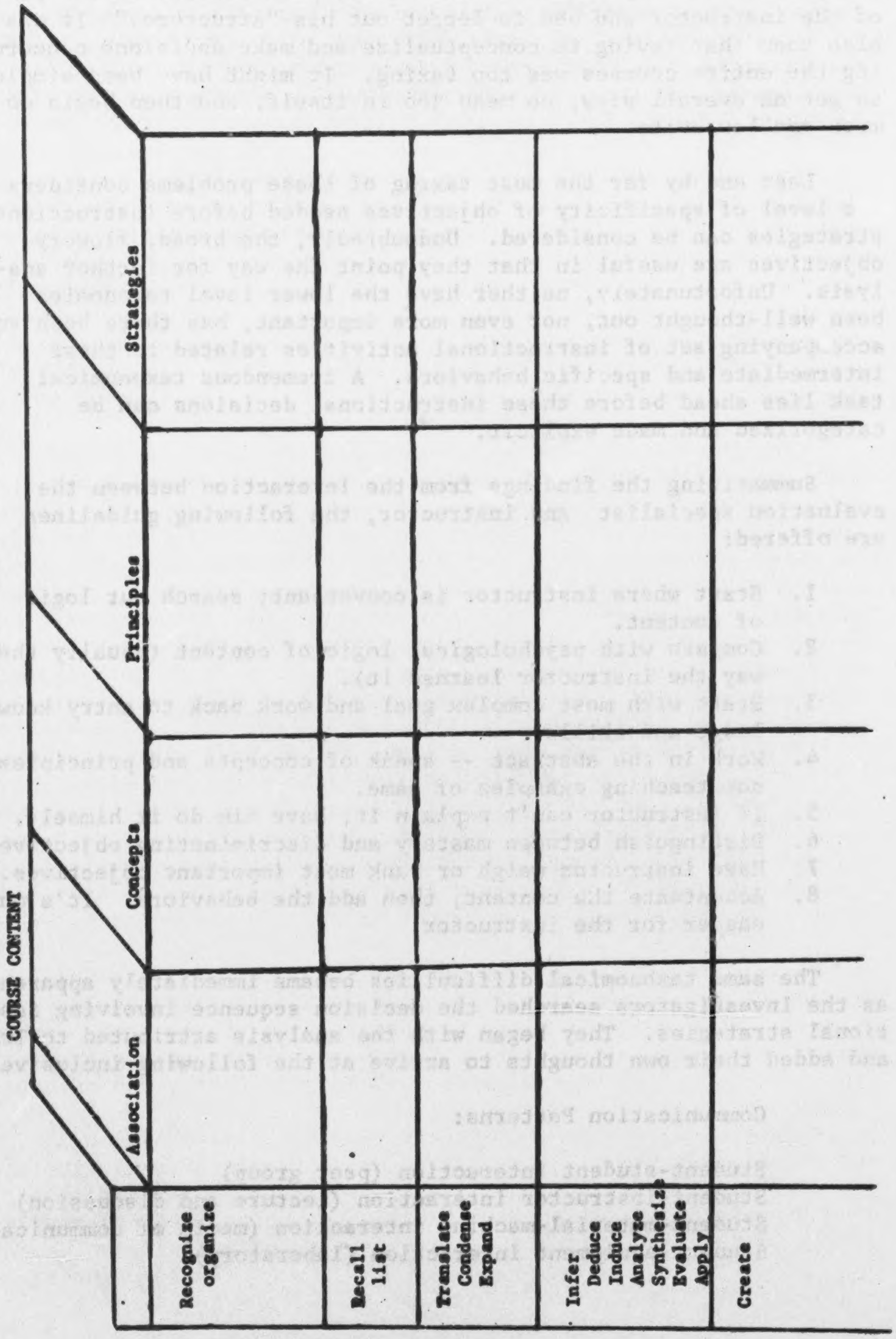
The immediate emphasis during the evaluation phase working with the matrix was to emphasize the teaching action-terminal behavior dimension. Although this proved enlightening for the instructor, the staff felt that it might have led to the confusion in their attempts to draw out the "structure." Therefore, it is now recommended that the instructor, with the help of his colleagues, attempt to work out his own curricular, structural problems, so to speak, before asking them to attack "behavioral terms." This mode of attack allows the instructor to begin the process in his own terminology rather than starting out with the unfamiliar "terminal behavior."

The study staff initiated another technique, which seemed to have a facilitating effect. That was to have the instructor determine what was the most complex action the student would be expected to perform. Working backwards seemed to be considerably easier than proceeding from the entry repertoire.

Three associated and interrelated problems arose that added to the confusion during the first phase: one dealing with the amount of instructor time that was allotted to this activity, a second having to do with the magnitude of tackling a full quarter's work, and a third concerning the specificity of the terminal behaviors. The trial interviews were conducted on a weekly basis during the summer for approximately one to three hours. All participants felt that daily sessions of greater length were needed to make any reasonable headway. There needed to be part of the day given to consultation

Figure 9

COURSE CONTENT-LEARNING BEHAVIOR MATRIX


COURSE CONTENT
Association
Concepts
Principles
Strategies
LEARNING BEHAVIOR
Recognize
organize
Recall
list
Translate
Condense
Expand
Infer
Deduce
Induce
Analyze
Synthesize
Evaluate
Apply
Create

and part of the day to individual study, particularly on the part of the instructor who had to ferret out his "structure." It was also seen that trying to conceptualize and make decisions concerning the entire courses was too taxing. It might have been simpler to get an overall view, no mean job in itself, and then begin on much smaller units.

Last and by far the most taxing of these problems considers the level of specificity of objectives needed before instructional strategies can be considered. Undoubtedly, the broad, flowery objectives are useful in that they point the way for further analysis. Unfortunately, neither have the lower level taxonomies been well-thought out, nor even more important, has there been an accompanying set of instructional activities related to these intermediate and specific behaviors. A tremendous taxonomical task lies ahead before these instructional decisions can be categorized and made explicit.

Summarizing the findings from the interaction between the evaluation specialist and instructor, the following guidelines are offered:

1. Start where instructor is conversant; search out logic of content.
2. Compare with psychological logic of content (usually the way the instructor learned it).
3. Start with most complex goal and work back to entry knowledge and skills.
4. Work in the abstract -- speak of concepts and principles, not teaching examples of same.
5. If instructor can't explain it, have him do it himself.
6. Distinguish between mastery and discriminating objectives.
7. Have instructor weigh or rank most important objectives.
8. Accentuate the content; then add the behaviors. It's much easier for the instructor.

The same taxonomical difficulties became immediately apparent as the investigators searched the decision sequence involving instructional strategies. They began with the analysis attributed to Trump (123) and added their own thoughts to arrive at the following inclusive list.

Communication Patterns:

Student-student interaction (peer group)
Student-instructor interaction (lecture and discussion)
Student-material-machine interaction (media of communication)
Student-equipment interaction (laboratory)

Other than logistic restrictions and "pet methods" they could find few principles which related strategy to type of objectives. For example, when is student-student interaction called for? What objectives are best met by programmed instruction, etc.? In other words, they could not find a "theory of instruction." At best, they could derive the following generalizations:

1. The more complex cognitive objectives call for interaction during issues discussion; feedback on problem-solving tasks.
2. The more difficult a concept, the more likely the need for adjunct programming.
3. One-way information should be in printed form whenever possible so students can attack it at their rate, not the instructor's.
4. Instructor is needed when one-way information is undergoing rapid change rendering printed forms obsolete.
5. Student-to-student interaction should only be allowed when pre-requisite information has been learned.

The next decision in the sequence was almost wholly that of the instructor, those dealing with teaching examples. It was sometimes necessary to have an awareness of the films, tapes, etc. plus projection facilities to aid in making these choices. The materials librarian, given explicit topics, was called upon to furnish a list of possible sources. The choice of the best example, that which most probably lies within the student's repetoire, is the creative act which marks the excellence of the teacher. It was felt that no quality of media could overcome the handicap of choosing an inappropriate example. It seems that this is the "art of teaching."

With strategy and examples given, it was now the media consultant specialist who came to fore. It was his responsibility to suggest both information forms and the subsequent type of transmittor that seemed suited for that form. In some cases, such as video tape, the transmittor potential would dictate the possible forms of information. In either case, specification of the strategy and examples were prerequisite.

The work of the media specialist with the instructor was aimed at converting the teaching examples into specifications for audiovisual equipment needs and procurement or production of audiovisual materials. The specifications were passed on to four different professional media workers, the audiovisual librarian, the graphic artist, the film producer, and the equipment-service coordinator.

The chief advantage accomplished in the use of the media specialist assistance appears to be a savings in time and the costs of time. The graphics man reported that both the electrical engineering instructors and theatre arts faculty members taking part in the procedures' test presented him with better defined and raionalized production requests than was the usual case. The differences he perceived between the two test courses were:

1. The teaching examples in electrical engineering were described in greater detail by the instructors.

2. The standardized graphic code for information used in electrical engineering speeded work on visual materials. Equivalent information in the theatre arts discipline was not as well-codified and required more consultation.

3. The graphics materials requested in theatre arts dealt with more general information than engineering and posed a greater design problem.

CHAPTER IV: DISCUSSION

Role of the Media Center in Instructional Development

The results reported in preceding chapters were distilled from a body of information and experience obtained through examining innovation of media in college instruction. This chapter presents the details of investigations from which the results were derived.

From the beginning, the investigators attempted to establish a persepctive or conceptual framework which would aid them in tagging the key elements in the media innovation process. Their design of hypothetical models for instructional development began simultaneously with the study of cases of media innovation at Michigan State University and the development of media agencies on campus. In examining the actual progress of these developments, they first considered what should be the most appropriate roles of specialists in the media field.

The major objective of those carrying the banner of audio-visual and the newer technology of instruction is the expanded and correct use of the devices which they have collected as their domain. Study upon study has assessed such subtlties as the open-mindedness of the faculty, their resistence to change, and other ways of seeking reasons for the felt discrepency between potential and usage. Few have had the insight and stability to examine their own activities or house rather than look for faults in the prospective user. This study changed from the question "What's wrong with them?" to "What's wrong with us?"

In simpler terms, how can the media center, as an instructional support unit, actually support instructors. . . support in the sense of helping them make specific instructional decisions. It was noted that these are the instructor's, not merely the audio-visual specialist's, decisions. Fortunately or unfortunately, depending upon the reader's bias, professors are usually not made aware of the complexity of principles which underly instructional decisions and their accompanying actions. As such, some professors are little more than good imitators, carefully duplicating the manner in which they were introduced to their discipline. The underlying rationale of a development approach is that as professors are asked to analyze their particular instructional responsibilities, they will become aware of the potential of the newer media that are available, and more important, they will realize the need for their use within the instructional setting. It is this realization of the instructional relevance of the devices, as they fit into the professor's own teaching pattern, which is the key to success through this approach.

At first thought, there could be a number of ways of providing a professor the means and setting in which to analyze his situation and thus develop these new insights. For example, audiovisual specialists could supplant and supplement his delivery. Or, the professor might have his instructional activities put on videotape so he and others can provide constructive suggestions. The others in this case could be his own students, the "others" in the videotape.

"But wait!" as many have said during visitations and conferences, "How do you ever get the professor to subject himself to this occupational inquisition? How do you get him to the door?" The investigators recognized this initial step, gave it the title of the "innovative phase" and began to probe. They found that not only does understanding this phase call for detailed analysis of the many and varied rewards within the university setting, but it also involved facets of all the behavioral sciences needed to devise ways and means to promote faculty involvement. Since their stated task was to prescribe activities after commitment to the instructional analysis, they concentrated upon the second or "developmental phase." In other words, after the professor is willing to discuss his instructional decisions and actions, what should be done? This rather straightforward task was translated as objective number three; to develop hypothetical models of instructional systems development procedures and relative costs. In simpler terms, it called for devising the possible ways in which the teaching support unit, A-V Center, Instructional Resources Center, whatever you call it can operate, given it has a professor willing to discuss his instructional change.

It is unrealistic to expect audiovisual centers, in the form the majority now exist, to have on hand the staff competencies needed to tackle the complex issues of instructional development. Not only do few centers come close to fitting any of the organizational models suggested earlier in this report, but hardly any are privy to the decision makers who influence teaching methods. The investigators noted with interest that innovation of newer media at Michigan State was facilitated by the administrative transfer of the Audiovisual Center from the Division of University Services to the Provost's Office, the chief campus academic affairs office. The transfer was based in part on the recommendations of the Michigan State University Learning Resources Center Study Committee which reported in 1962 and are listed here.

Summary of Recommendations

1. All activities concerned with the improvement of instruction and the effectiveness of the University's learning resources should be placed under the supervision of the Office of the Provost. These include the University Library, Museum, Electronic Computer Services, Closed-Circuit Television, Audiovisual Center, Language Laboratories, Automated instructional devices for programmed learning.

2. In-service training should be instituted for graduate assistants and new faculty appointees of the lower grades.

3. Funds controlled by the Office of the Provost should be available to academic units for studies of their instructional systems and methods.

4. A Learning Resources Center should be instituted and a director appointed therefor.

   a. This Center should coordinate and determine specific policies for the operation, development, and utilization of various services which provide teaching and learning resources, including closed-circuit television, motion picture films, still visuals, programmed learning, and auditory instructional devices.

   b. Regarding these services, separate emphasis should be placed on the design and production of learning materials, as distinguished from their storage and distribution.

   c. The Center should also include two new services: (1) a Learning Research and Analysis Service, (2) an Instructional Systems Development Service.

   d. Provision should be made for the possible inclusion of new services and the adaptation of the present services to new developments.

   e. The Center should be housed in a suitable new architectural complex, preferably adjacent to the Library, Museum, and broadcasting operations, with which it is expected to cooperate in certain of its activities.

The actual transfer of assignment occurred some three years later and introduced a change in the revolving fund support basis for media services, as well. The new alliance was announced in a memorandum to deans and department chairmen. It specified the following changes in administrative responsibility and service charges:

1. Change in Administrative Assignment

   As of July 1, 1965, administrative responsibility for the Audiovisual Center will be transferred from Dean William Combs, University Services, to Dr. John Dietrich, Assistant Provost.

2. Free Audiovisual Service

As of July 1, 1965, regular audiovisual services typically provided for classroom instruction on the Michigan State University campus in East Lansing, will be provided without charge to academic departments. Regular audiovisual services are defined as including projection and recording equipment, films, tape duplication, public address, projectionists and technicians, and accessories for classroom instruction. Production work in Graphics, Film and Sound Recording will continue to be charges to departments as in the past.

All requests for audiovisual services will continue to be provided for all users to the fullest extent possible. In the event that availability of equipment, personnel, or funds make necessary some limitation of service, priorities may have to be established. Assistance of the faculty in keeping requests at a reasonable level will help assure optimum benefits to all departments from the free audiovisual service arrangement.

In order for the free service to function smoothly, it will be necessary for departments desiring services to observe certain operating procedures such as the following:

a. Advance booking is essential for good service. Requests made less than one (1) working day in advance cannot be assured service.

b. The extended use anticipated under free service will require optimum employment of resources. Accordingly, long-term assignments of projectors, tape recorders, etc., will be limited by overall University requirements.

Audiovisual services of all types will continue to be provided on a charge basis for the following University functions in this order of priority:

a. Campus conferences and programs.
b. Off-campus courses and programs.
c. Projects and Institutes funded by outside agencies.
d. Extra-curricular and non-academic programs such as clubs, residence halls, and fraternities.

Evolving the Instructional Development Model

The decision at Michigan State University to support some audio-visual services from general university funds and to move it under the supervision of the University's chief academic office, the Provost, increased resources and opened new avenues of operation and service. No longer would the center be entirely dependent on the occasional "customer." Instead, any instructional problem at the institution might be directed to its door for assistance.

This possibility raised the critical question of the appropriate limits of media center services; that is, at what stage should an instructional problem be intercepted. Some argue that the media center should confine its concerns to materials design and production. Others contend that production of materials without ascertaining the appropriateness of materials requests, i.e. their ultimate purpose, is a blind approach.

Regardless of the viewpoint the reader accepts, there is general agreement that the analysis of instructional problems is broader than merely the decisions on media innovation. This raises the question of who can best assist the instructor in examining his problem and where should this person be located. The general trend to centralize media services offers some reasons to include the teaching problem analyst in the media center. These proponents argue that the specialists required for these analyses can operate most efficiently when attached and located within a learning resources center, or other instructional development facility. Under this concept, the instructional specialist is concurrently employed with several on-going developments, rather than concentrating only on one.

A centralized plan of operation requires academic departments to come to the center for solution of given instructional problems. The specialists are assigned and work with the department staff to its conclusion of problem analysis and media production. The advantages of the centralized location are: (1) a greater concentration of specialists expertise can be brought to bear on the problem, since more than one specialist might be employed; (2) more convenient communication of instructional media production specifications can be accomplished; (3) the faculty member is removed from distracting pressures within his department and may obtain a more objective view of his instructional problem; (4) the solutions achieved by one academic department might be shared more easily with others, even though content areas may vary widely; and (5) the allocation of financial resources can be adjusted according to the magnitude of the instructional problem without restrictive departmental budget allocation.

On the other hand, there are strong arguments to conduct instructional problem analysis on a decentralized basis; that is, within the academic departments. The strongest point made is largely strategic, it allays faculty anxiety concerning who is really in charge of academic decisions. Other points for decentralized instructional development are: (1) greater availability of the professional opinions of colleagues; (2) greater proximity to department policy makers; (3) better reference to content (e.g., lab equipment, technical materials, library resources, etc.); (4) student group reaction possibilities; and (5) more flexible development work schedules.

No recommendation is offered by the investigators regarding the location of the instructional specialist. They do offer the observation, however, that centralized media facilities appear to offer the most effective and efficient operation. Also, given a positive faculty attitude, the advantages of decentralized instructional problem analysis could likely be built into a learning resources center through specially designed liaison procedures and physical facilities.

Recognizing the probability that media innovation will occur as a centralized activity on some campuses and decentralized on others, the investigators attempted to devise a procedural model applicable to both arrangements. In addition, they tried to arrive at development steps suited to instructional media innovation efforts of a single instructor, as well as the instructor aided by a team of specialists from a learning resources center.

Examining the Systems Aspects of Instructional Media Innovation

The investigators recognized early that the procedures they sought to devise represented a model system of a sort. It was found useful to examine the possibilities offered by the system approach used in some sectors of the physical and social sciences. Their study of systems work in technological fields revealed its wide use for analysis of complex structures. This is accomplished through descriptive resolution of complex systems into a heirarchy of simple sub-systems. The new-found simplicity permits cogent observation and at times makes clear the adjustments necessary for improved operation.

Despite the success of systems approach in the sciences, it appears to have only limited use in education. Perhaps the obstacle is the low reliability or lack of learning "principles" -- cause and effect statements. Its chief usefulness is a conceptual framework on which to array the identities and relationships of university functions and participants.

General systems methodology permits a system to be defined as any grouping of components, which operates in concert or related fashion. It is not too difficult to employ this concept to describe a university. For purposes of the study, investigators viewed the university as representing a sub-system of society, or in effect, a system in itself. Within its boundaries exist a number of sub-systems, among which the most pertinent to the study are those systems' relationships permitted investigators to concentrate their attention on intra-system operation without losing track of inputs which affect these sub-systems.

One would be hard-pressed to closely relate to instruction all activities, persons, and facilities comprising a modern university. The investigators sifted through these components in order to select those particularly relevant to the instructional system. The identity of the components and relationships found withhin the instructional system are defined by the investigators as:

> An instructional system is a complex consisting of a learner(s) and a combination or all of the following components: Instructor(s), material(s), machine(s), and technician(s) given certain inputs and designed to carry out a prescribed set of operations. This set of operations is devised and ordered according to the most recent and pertinent evidence from research and expert opinion such that the probability of attaining the output, specific behavioral changes in the components, is maximal.

It is pointed out that definition of a theoretical relationship among components contributes only a start to constructing a purposeful instructional design process. The more demanding task is the specification, ordering, and implementation of decision or content and behaviors which produce the desired instructional system. The investigators called this the development system and defined it:

> Development System: That complex of instructor(s) and specialist(s) created to make decisions relating to specific actions within an instructional system.

The concept of a development system implies considerably more control of outcomes than is normally associated with curriculum work. Only a few investigators have explored a systems approach for instructional development. Carpenter (22) offers general guidelines:

A SUGGESTED SYSTEMS APPROACH TO TEACHING AND LEARNING

Research as to how, when, and where to use television in education may benefit from an adaptation of the systems analysis approach to the problems. This approach, which has been developed and tested in military contexts, and is being extensively used in industry, may prove to be helpful in integrating the "new" media, including television, into our schools and institutions of higher education.

The general requirements are known for employing this higher order "man-machine systems approach" to the solutions of complex operational problems like those of education and including the media sub-systems. They are the following:

1. Achievement or performance goals are defined.
2. These goals are then translated into sub-systems of general and specific functions.
3. The means of executing these functions are specified, and components of the systems are defined to include human capabilities, machines, materials, and their interaction in the system.
4. Distinctions are made between those functions which can best be performed by persons with known competencies and those which can best be performed by instrumentation and materials with known characteristics.
5. Schedules and sequences of events are so planned that all components of the systems, sub-systems, and functions operate as required and in an orderly manner. The designed system, when tested and re-tested, may have its components changed or re-ordered to maximize the performance of the system as a whole in accomplishing projected goals or objectives.

In developing a hypothetical model of a development system, the study team, in essence, synthetically determined relatively standardized sets of procedures which would most efficiently meet specific instructional objectives. The plan called for determining both the logical chain or general decisions, and who among the participants was to assume the responsibility for these decisions. When this was decided, the investigators simulated and evaluated the decisions. This simulation gave further feedback as to the efficiency and effectiveness of several model variations. With this information they chose the most effective model of those hypothesized for use in the field test which served to further refine the development steps.

Devising A Model To Describe Media Innovation In Instructional Development

The value of a model is largely measured by the degree to which it communicates what it purports to represent. The model designed through course development observations in this study is intended to depict a decision-making process; i.e., the general sequence of decisions which determine the selection and use of media in teaching a college course. The investigators actually observed and recorded the activities included in the model in several simulation exercises conducted to make the process more explicit. The chief problem encountered in proposing the model is to communicate to the reader the fact that a good deal of the surrounding circumstances has been stripped away to reveal the steps of the model, and the fact that even so the model still masks a considerable number of involved decisions.

The use of models for descriptive purposes is common practice in the physical sciences and some of the social sciences, but it is somewhat uncommon in education. Many of the models found in the literature of education are closely patterned after prototype physical and social system schema.

Ackoff (1) identifies and defines three different types of models used in science and other research activity, the iconic model, the analogue, and the symbolic model.

> Iconic models are large or small-scale representations of states, objects, or events. . .Iconic models look like what they represent. For example, road maps and airial photographs represent distances between, and relative positions of, places and routes between them. . .flow charts which show the processing of material or information may also be iconic models, as may be floor plans or other types of diagrams. . .
>
> In most cases, if we want to show relief (i.e., the third dimensions, elevation) on a map we do not produce a three-dimensional map; rather we resort to colors or to contour lines which by their distance apart convey information about grades. . . in these cases, one property is used to represent another, and hence the necessity of a legend. In such cases, the model is an analogue. . . graphs in which such properties as costs, time, numbers of people, and percentages are plotted are also analogues. . .
>
> Finally, there are symbolic models in which the properties of the thing represented are expressed symbolically. Thus, a relationship shown in a graph (an analogue) can also be shown in an equation. The equation, a symbol employed representing quantities, are usually called mathematical models. . . .

Essentially, the model produced by this investigation is in the iconic category; i.e., flow charts of the decisions within the instructional development system which produce the instructional system.

The investigators chose to restrict the scope of the model to include only those instructional decisions which relate to the goals of acquiring knowledge and the development of those skills and abilities to use knowledge. Bloom, Krathwohl, and others (12) outline these goals in the Cognitive Domain of their taxonomy and differentiate from those having to do with other learner behavior, described as effective and psychomotor. In addition to narrowing their concern, they restricted the decision in the models to those decisions which relate closely to the production and usage of newer media. Procedures leading to other outcomes in the overall educational scheme are merely implied.

The prescription of instructional development steps is no simple task. Educational research has not yet provided enough information to fill in the "unknowns" of the development procedures. Investigators found that many of the specific steps inserted in the process were largely opinion-based (almost 80%), theirs and those of others.

For instance, in step one, a legend request is made for determination of the system's educational objectives. Objective setting, although purportedly practiced by almost all educational units, is poorly understood. An interesting perspective on this task is offered by Krathwohl (74), who allows that, "Objectives at several levels of generality and specificity are needed to facilitate the process of curriculum building and instructional development." He suggests three levels are useful: The first, an "abstract" level for laying out types of courses and areas to be covered; the second, "behavioral" objectives aimed at specifying the goals of an instructional unit, a course, or sequence of courses; and a third level needed to create instructional materials. The ability to scheme details at the third level is vital to the incorporation of the newer media in course instruction, however, considerable difficulty is associated with such work.

> We do not have enough psychological knowledge for the teacher and the developer of instructional materials to move with certainty from an intermediate-level objective to a single set of very detailed and concrete objectives. In the example given above, for instance, we have little theoretical basis for judging the language forms and patterns that will permit the most complete understanding of literary material. Both the instructional material specialist and the teacher precede the psychologist into areas of most-needed research. They must make choices while the psychologist is still developing the knowledge to help them. (74)

The absence of factual information and research results restricted the detail to which the steps in the development model could be specified.

Analysis of the cases of actual media innovation evolved a logical sequence of decisions that seemed to be evident in most instructional development.

POSSIBLE SEQUENCE OF DECISIONS THAT ARE INVARIANT OVER ALL DEVELOPMENT OF INSTRUCTION SITUATIONS

DECISIONS:

(1) Goals of institution:

(2) Relation of specific course to overall goals?

(3) Specific student terminal behaviors pertinent to course?

(4) Choice of body of information needed to achieve terminal behaviors?

(5) Determine relation between knowledge and behaviors?

(6) Determine instructional message:
  a. what information transmitted (given)?
  b. what information "discovered" by learner?

(7) By what vehicle is the information best transmitted (given) and called for?

(8) What vehicles are best for the transmission of the "discovered" student response?

(9) What actions are called for when:
  a. the response is correct?
  b. the response is incorrect?

(10) What behaviors should be called for in total evaluation instrument?

(11) Who devises, corrects, and analyzes the instrument items?

(12) What instructional actions should be altered, and how, from analysis of the criterion data?

This sequence of decisions was then converted into a flow chart of administrative functions to be performed by the faculty member with the assistance of a specialist.

Figure 10

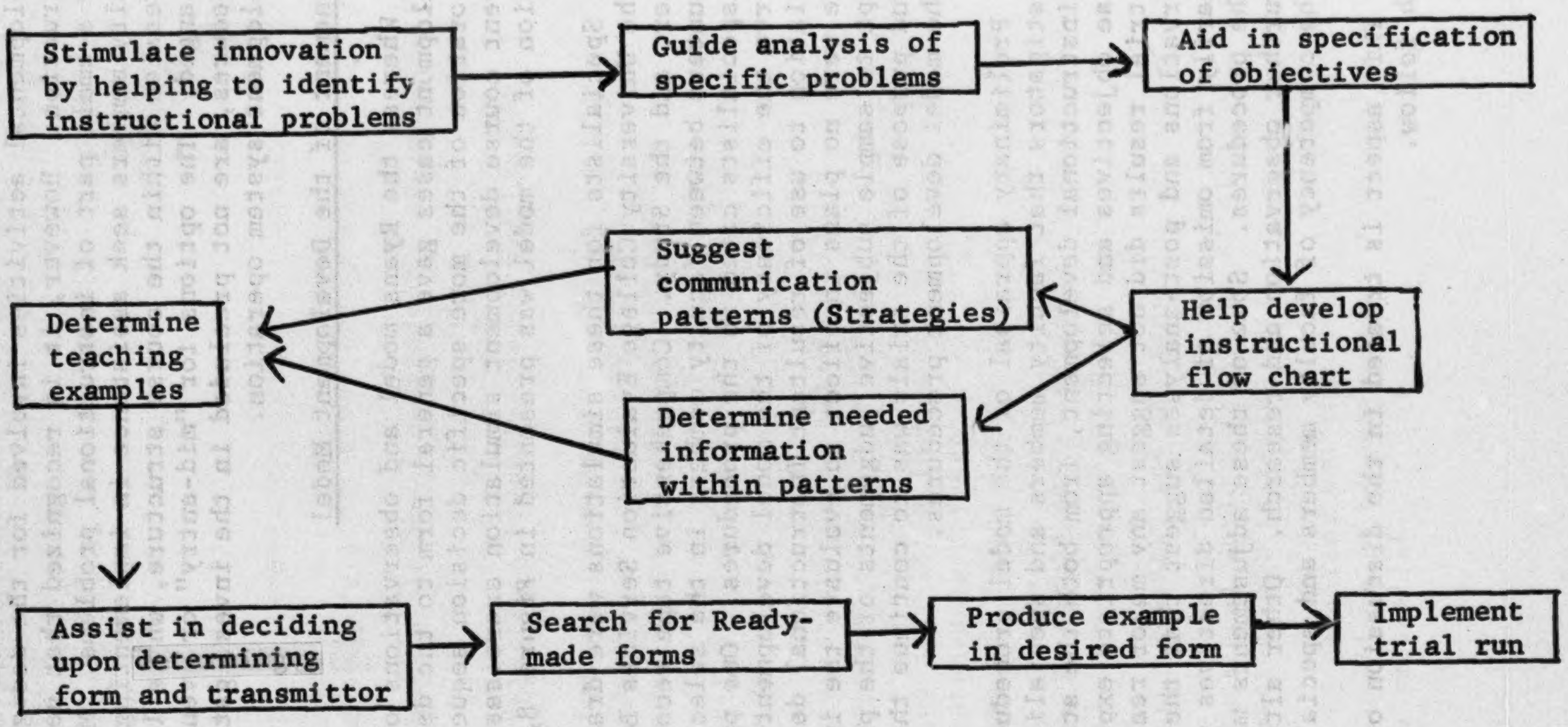
PROPOSED INSTRUCTIONAL DEVELOPMENT FLOW CHART

1. Determine nature and extent of instructional problem.
2. Determine input data. Range of input.
3. Determine broad objectives from department representatives.
    - A. Develop brief syllabus.
4. Determine more specific objectives.
    - A. Develop criterion instrument or operational plan for it.
    - B. Determine scoring and analysis policies.
5. Determine more specific objectives needed to make instructional decisions.
    - A. Determine information and skills needed to accomplish specific objectives.
        - 1. Determine internal logic of sequence underlying the objectives.
    - B. Determine need for student response.
        - 1. Determine appropriate areas for following types of interactions:
            - a. Student - himself
            - b. Student - teacher
            - c. Student - student
            - d. Student - representative person (student teaching)
    - C. Determine sources of new information.
    - D. Determine methods of transmission of new information.

Further structure was given these decisions through the conception of a learning resources center, a specialized university facility dedicated to the analysis of instruction, the development of instructional strategies, and the provision of supporting materials and devices. A flow chart of the gross development procedures appear in Figure 11 .

Figure 11

SIMPLIFIED DEVELOPMENTAL SYSTEM FLOW CHART


Stimulate innovation by helping to identify instructional problems
Guide analysis of specific problems
Aid in specification of objectives
Help develop instructional flow chart
Suggest communication patterns (Strategies)
Determine needed information within patterns
Determine teaching examples
Assist in deciding upon determining form and transmittor
Search for Ready-made forms
Produce example in desired form
Implement trial run

The development procedures shown here apply primarily to the developmental activities involved for the design of a new course instruction. However, it is recognized that new courses represent only a small part of instructional problems. More typically, faculty members seek assistance in implementing media in some portion or session within the course structure, while leaving the balance unchanged. The options for "mid-entry" or even "dipping" in the procedures, are not precluded in the investigators concept of the development system operation.

Refinement of the Development Model

Whereas the Ryans model and observations of actual course development cases gave a general form to the development model, the exploration of the more specific decision sequences required concurrent course development simulation exercises. The more refined version of the model was presented in Figure 8, page 55.

Specialists for these simulations were drawn from existing staff of the University College Evaluation Services Bureau, the Audiovisual Center, and the Study. Comprehensive tape recordings were made of all encounters between faculty members in the selected academic areas and the specialists cited in the procedures. One purpose was to closely observe the efficiency of the model development procedures from their initiation to use of resultant instructional design and materials. There were no plans in effect to evaluate the improvement in learning, except to sample subjective judgements of the professors involved. A second purpose of the trials was to continue the re-shaping and detailing of the model development procedures.

Preliminary appraisal of the model procedures suggests to the investigators that faculty members and specialists find them useful for instructional development, from both the standpoint of clarifying course objectives and selecting appropriate experiences and materials. The trial results did not suggest any major realignment of the procedures. Observations and post-analyses suggest that the adjustment needs arise primarily from omission of detailed directives within the major steps of the procedures. Some of these adjustments may require the findings of further observation and research. Other alterations are largely limited by the competency of faculty members and specialists.

This aspect is treated in the discussion of specialists' roles which follow.

The Role of Specialists in Instructional Development

Rather than be like the old saw that says, "Everybody talks about the weather, but nobody does anything about it," the investigators undertook to do something about testing development procedures in a design with instructors, teams of specialists, and course content as factors.

The simulation of instructional development procedures was aimed at refining the steps of a hypothetical course planning system and initially testing its practicality. The instruction treated was two eleven-week courses, although the procedures could have been employed for shorter within-the-course experiences. The decision-making sequence in the system was shared by three specialty groups; those dealing with evaluation, instruction, and media. The main functions of these specialty groups were thought to be:

Evaluation -- to help in identifying student behavioral objectives and developing pre and post criterion instruments.

Instruction -- to aid in the determination of strategy; i.e., self-study, need for live teacher, etc. (works primarily with behaviors).

Media -- to assist in making representational and transmission decisions (works primarily with teaching examples).

The instructor brought to the situation the ability to: (1) clarify the department's objectives for the particular course in both content and behavior terms; (2) specify the expected entry behavior of the students; and most important, (3) develop meaningful teaching examples of the concepts and principles within the selected content.

It should be pointed out that the development of a multi-section course, one in which several instructors are involved, differs in the initial planning steps from the case where a single instructor does all the teaching. The multi-section course may require some concurrence of objectives among instructors, if the new developments are to apply to all.

The simulation of development activities was based only on the single instructor situation.

The specialists obtained to play the various roles came to their tasks with varying qualifications. The simulation involved revision of actual courses for which new teaching methods and materials would be devised and used in the fall quarters of 1964 and 1965.

Conceptualizing the Roles of Specialists

As illustrated earlier, the model procedures are aimed at putting expert knowledge and competencies to work in instructional development. The investigators singled out these competencies and differentiated those which could be assigned to the province of separate specialists, yet maintained related and interlocking responsibilities within a specialist team. The simulated teamwork is designed to operate in the setting of a centralized learning resources center, although the development steps may well operate in decentralized operations as well.

The first step represents the "public relations" activity that gets the instructor to the learning resources center. The concern for motivating faculty in instructional improvement has grown to the point that it obscures the more important question, "How does the professor go about changing his teaching once he makes this decision?"

Various stimuli can encourage desire for instructional improvement, including advancement and financial rewards.

The investigators chose not to permit others to explore the labyrinths of this "persuasion system," but to concentrate on what can be done for the instructor once he knocks on the door. The broad analysis of instruction often results from a simple request to the media center for procurement on production of instructional materials or a request for assistance in testing procedures, such as offered by the Evaluation Services Center at Michigan State.

The development model visualizes the first person making contact with the instructor would observe that the problem needs more than the "quick fix" assistance of an overhead transparency. Admittedly, expecting this kind of judgment may be unrealistic considering the typical amount of course information available in such requests, and the reluctance of academic departments to become involved in sizeable expenditures of time and money. Indeed, many situations may only need some expert lettering of graphics or other simple media usage to improve things.

A large potential cast of specialists was suggested for the procedures simulation as shown here.

CAST OF PARTICIPANT ROLES AND RESPONSIBILITIES FOR DEVELOPMENT PROCEDURES SIMULATION

I. Instructors

A. Those who teach a common course where there are either more than one teaching the "same" course, or the course content has been specified by a committee or some higher authority.

B. Those who are instructing in courses created for their specialty are given full responsibility for decisions as to content and teaching method.

II. Specialists

A. Administrative:

1. Academic area administrator -- has responsibility for many input decisions such as facilities, finances, supplies, and materials, availability of machines, etc.

2. University administrator A -- approachable a person in faculty's eyes, who oversees activities of instructional specialists, coordinates scheduling concerned with operations research or management and control of system in operation, wants efficient operation within given system.

3. University administrator B -- acts as a systems designer for developmental systems, or communications systems; a procedures analyst who plans and designs systems of operations, sets of procedures, and is concerned with efficiency of overall larger systems of which Learning Resources Center may be sub-system. Deals with all instructional operations within the university.

B. Curriculum:

1. Curriculum advisor -- cognizant of overall university objectives able to relate the specific course to these and determine its validity as an integral part in this total picture.

2. Curricular leader -- able to oversee operations of other specialists--aware of process problems, the sequence of relative importance of certain activities, need for general understandings, etc.

3. Special area curricular advisor -- individual or committee who decides upon what content and objectives of core courses are.

4. Curriculum specialist -- aids all instructors in specification of desired objectives and relation to subject matter, and helps instructor in determining structure of subject matter.

C. Media:

1. Media specialists (as now conceived) -- aids instructor in determining objectives; making methods decisions; introduces instructor to media potential; refers instructor to produce once methods or technique decisions are made; plays some part in evaluation of product (not well defined); and assists in budgetary considerations.

2. Media systems designer -- oversees developmental systems operation; familiar with most efficient operation of given procedures; may also be concerned with innovating new set of procedures of renovating the old; and serves as specialist's team leader under direction of learning resources center director.

3. Media producers -- assist instructor in development of instructional materials, films, TV, programmed books, graphics, etc.

4. Media technologist -- specialist in media areas dealing with operation, design, and maintenance of equipment.

5. Instructional materials or resources librarian -- catalogues and dispenses instructional materials of all kinds.

D. Evaluation:

Evaluation specialists -- aids instructor in defining operationalizing and measuring of objectives; assists in writing items for examinations; advises in or carries out scoring and statistical tabulation; and provides normative data and evaluative reports which include item analysts, propose changes, annual progress, expectency tables, etc.

E. Communication:

Communications specialist (function not determined)

F. Educational Psychology:

Instructional specialists -- assist the instructor in relating personality, motivation, and learning theory to instructional methods decisions; familiarity with both methods and machines potential and underlying rationale; cognizant of different capabilities of methods and machines and how they relate to the structure of the subject matter; and development of the student.

Actually, only a few of the many specialists listed here were employed in the procedures simulation: the evaluation specialists, the instructional specialists, the media specialists, and several media production personnel. It was impractical to simulate and observe with more than this number in the time available. The most significant observation was that the effectiveness of the development model procedures is heavily dependent on the competencies of these specialists. Their work in the simulated course development in the theatre arts and engineering course is briefly described here.

The Evaluation Specialist

The decision to employ a specialist from educational testing to play this role appears well-founded. His experience in seeking statements of objectives for test items construction equips him with the know-how to seek information for the other specialists' work in instructional development. This specialist starts by obtaining an inventory of resources available for course development. Figure 12 illustrates forms used by the investigators' simulation.

Figure 12

INSTRUCTIONAL SYSTEM DEVELOPMENT STUDY
Input Data Sheet

PROJECT #: ____________
Date: ____________

(I) Course Name, Number, and Catalog Description:

(a) Relationship to other courses (sequence, etc.)

EE252P, Linear Systems I, 4(4-0). Physical measurements and their mathematical representations. Forms of mathematical models of two-terminal and multi-terminal components. An introduction to matrix algebra.

This is the first course in a seven-term sequence in the Analysis of Physical Systems. It assumes a mathematical background through the Calculus and Differential Equations (at least as a parallel course) and approximately one year of both Physics and Chemistry.

(II) Expected Student Enrollment Per Term:

60

(III) Present Schedule Sequence and Flexibility to Change:

Presently as three sections, approximately 20 students to each. Four fifty-minute class sessions per week per section. Some flexibility can be provided, if input data is available early enough to allow smooth faculty and student scheduling, etc.

(IV) Classroom Facilities:

(a) Now in use: Standard Classroom, capacity approximately 30 students.
(b) Available: Possibility of use of larger room, capacity approximately 70 students.
(c) Restrictions: Room scheduling, reservations now made, etc.

(V) Availability of Instructor(s) for Development Activities:

Two instructors available on or about June 15, 1964, to make plans and prepare for classroom use in Fall Term, 1964.

(VI) Finances Available (Indicate Range):

(a) Course Operation	Amt.	(b) Course Development	Amt.
1. Staff	$1600	1. Staff	$1600
2. Materials	400	2. Materials	400
3. Equipment		3. Equipment	

(VII) Departmental Aids to Instruction:
(Graduate Assistants, Motion Picture Projectors, Language Lab, etc.)

None available at present time.

(VIII) Specific Course Aids Available: (Bibliographies, Study Guides, etc.)

List of reference texts can be made available for parts of course.

(IX) Syllabus: (attach copy if available)

Copy of course outline as used Fall, 1963, is attached.

(X) Departmental Policies Having Direct Bearing on Specific Course:

Department policy allows considerable freedom in development of course content and teaching techniques in this course, within bounds of providing proper preparation for further courses in sequence (and others).

(XI) Additional Information Pertinent to Situation:

This course is a part of a "pilot program" in curriculum development. Extensive work has been done in the Curriculum Development program relating to course content but little formal effort has been devoted to teaching techniques. This program is expected to provide valuable experience in the applicability and use of various media.

After Fall Term, 1964, under a new departmental curriculum, this particular course will no longer be offered. However, it has been selected as the developmental vehicle since the first course in Systems Analysis in the new curriculum will include much of the material now a part of this course. The course description given in part I relates to the present pilot program course.

It is conceivable that the inventory analysis could be performed by the instructor without the aid of a specialist, using some refined check list. The assistance of the evaluation specialist is more definitely helpful for tackling questions on behavioral objectives as such:

1. What behaviors do you want the student to be able to do:
    a. At intervals during the course?
    b. Immediately following the conclusion of the course?
    c. At specified times after the course has concluded: 6 months, 1 year, 5 years, life?
2. What information and skills does he need to accomplish these behaviors?
3. What information relates to what behaviors?
4. Who will sample these behaviors and develop test items from these behaviors?
5. Who will score and analyze the answer sheets?

The difficult mission in this interrogation is to help the instructor clarify his goals in a form which is specific enough for test item writing. It should be pointed out that these objectives, when defined, represent only the intermediate level of information. The specialists further along the line ask for more specific details within these objective statements.

During this step of the analysis, the specialist should encourage the instructor to share his observations and conclusions. Among many instructors there is anxiety that a close look at their decision process for teaching will somehow diminish their creativity. This argument evaporates rapidly if an instructor can be made to observe that his final examination outcomes are often unrealistic in terms of the information and learning experiences available to the student in the course. This perception must be achieved fairly quickly if the instructor is not to be alienated, or consider his subject too involved for purposes of stating objectives.

One of the instructors in the procedures simulation reacted to the task as follows:

> I guess my first reaction was when I heard that this (help) was likely available, was not necessarily one of fear, but what is going to happen here? I was not too terribly concerned, since you said the last decision would be the instructor's. Of course, naturally everybody would defend that, but I was afraid of what am I getting into?

I see now what you people are trying to do. Aid in method and procedure and no sense in evaluation of the subject matter, etc., but merely how the instructors can effectively use the knowledge that you have.

For institutions who have no evaluation experts to employ in this analysis, the investigators suggest these guidelines for defining objectives:

1. Start where instructor is conversant; search out logic of content.
2. Compare with psychological logic of content (usually the way the instructor learned it).
3. Start with most complex goal and work back to entry knowledge and skills.
4. Work in the abstract -- speak of concepts and principles, not teaching examples of same.
5. If instructor can't explain it (the task to be learned), have him do it himself.
6. Distinguish between mastery and discriminating objectives.
7. Have instructor weigh or rank most important objectives.
8. Accentuate the content; then add the behaviors, it's much easier for the instructor.

A number of recommended changes for future evaluation procedure trials were derived from analyzing the tapes of evaluation specialist-instructor sessions.

1. Additional advanced preparation of the evaluation specialist is needed.
2. Both client and evaluator need to have studied preconference materials.
3. Additional examples of specific subject matter objectives developed for each "typical" academic discipline would be helpful.
4. A copy of a typical final exam should be available during the conference. It would be most helpful in aiding communication.
5. Considerable skill needs to be exercised by the evaluator to avoid any intimation that the client is being evaluated; e.g., that he as a teacher is being evaluated.
6. It would appear that some experience on the part of the evaluator in the subject matter area would expedite the procedures.

Unfortunately, evaluation specialists, thanks to new emphasis on behavior statements, are only recently learning how to specify learning tasks better. This is "unfortunate" because we have little idea as to how to go about achieving them. The great "open sesame" that educators have dreamed about; that is, wait until the objectives are finally spelled out, is turning out to be more of a nightmare instead of finding the gold and riches in terms of easily identifiable instructional strategy and media specification. The awful truth is that we have little idea of how to develop instructional conditions to meet these specific objectives. This was the prospect as the evaluation specialist, parting with the instructor, indicated the kinds of tasks the next person, the instructional specialist, would undertake.

The Instructional Specialist

The next development step represents the beginning of the domain of the instructional specialist. There were no personnel available to adequately play the roles of the instructional specialists as the investigators saw the function. Not being able to find trained individuals for this role is one of the most important findings of the study. As such, the media specialists were forced to play dual roles and go beyond media decisions. Most media centers, where activity of this sort is being carried out, employ media personnel in this capacity.

The scope of knowledge required for this specialist is enormous. He must have a grasp of what research recommends as effective teaching and, if possible, have practical experience in areas not yet explored by researchers. This breadth is suggested by the list concerns introduced by the simulation. There are likely more to be found.

1. Is there a logical learning sequence inherent in these behaviors?

2. Is there a logical sequence inherent in the information related to these behaviors?

3. Are some students already able to carry out any or all of these prescribed behaviors?

4. If yes, what provision will be made to allow for individual differences in entry behaviors?

5. At what points in this learning sequence of behavior and related information will there be a need for student overt response; i.e.:

    a. making inferences
    b. practicing a skill
    c. information retrieval

6. Who and how should the student be stimulated to respond?

7. Who and how should one react to this student response?

    If he is correct, do this. . . . .
    If he is incorrect, do this. . . . . . .

8. Are there bodies/areas of information either substantive or directional which can be uniformly presented to all students?

9. Are there bodies/areas of information which the student can better study at his own pace?

10. Are there bodies/areas of information that dictate the need for student discussion?

11. Are there bodies/areas of information that dictate the need for student-teacher discussion in private, or in class?

In the simulation, the instructional specialist role was to complete the instructional development flow chart, the logical and psychological sequence of the total course. This is no mean task, but leads to the spelling out of one of the major variables concerned with effective instruction -- that of sequence, discussed earlier in this chapter.

The selection of communicative patterns, or better known as the Trump plan decisions, was next. Unfortunately again, there are few clues within the information gathered that leads to suggesting programming, large or small classes, etc. In most cases, either the instructor has a "pet method," or some logistic restriction determines the final choices.

Of course, if financial restrictions are such as to rule out certain more costly teaching strategies, the search for a "best" solution is narrowed automatically.

This fact adds to the importance of the earlier inventory step. The investigators briefly flirted with the idea of developing a teaching method priority indicator, which would designate the avenues of instruction suggested by preference. This preference indication was to be completed by the decision maker (administrator, dean, professor?) who had the final "go" or "no-go" power. Further consideration prompted the investigators to abandon this approach in favor of determining the worth of alternative teaching methods. The value of effectiveness might well convince cost-conscious administrators that a previously unacceptable expenditure is worthwhile.

Some guidelines evolved for determing teaching strategies are:

1. The more complex cognitive objectives call for interaction during issues discussion; feedback on problem-solving tasks.

2. The more difficult a concept, the more likely the need for adjunct programming.

3. One-way information should be in printed form whenever possible, so students can attack it at their rate, not the instructor's.

4. Instructor is needed when one-way information is undergoing rapid change rendering printed forms obsolete.

5. Student-to-student interaction should only be allowed when pre-requisite information has been learned.

The instructor comes into his own when the choice of concurrent information within each pattern is decided. It's his discipline. It is also his task to generate teaching examples. This is a creative act. It might well be that a specially inventive man within each discipline be singled out to help in this vastly important task. The best choice of media still can't overcome choosing an inadequate example.

The simulation experience suggests the following general procedures be used by the instructional specialist in working with the instructor:

1. Review the initial procedures working through any semantic difficulties.
2. Develop more fully, in the sense of more specification, any of the areas covered in the initial analysis procedures.
3. Derive from the data priority of skills and tasks to be developed within the course. (These are usually located toward the right lower corner of the matrix in Figure 8 .
4. Determine the interrelationships among these priority tasks. Are they dependent upon each other in a unique way? What is the logical sequence inherent in these tasks?
5. Taking one of the complex tasks (one which has no subsequently more complex than it), develop the logical chain of content (information, subject matter) needed to enable the student to adequately carry out the task. (If this is a manipulative -- psychometer task, include both content and physical manipulation with objects.) The organization of a textbook is based upon this logical chain, but usually has not made the direct tie-in with specific skills and tasks. The development will generally follow these steps:
    a. What principles are involved (or possibly strategy) in carrying out the task?
    b. What concepts are needed to comprehend the principles?
    c. What are the most meaningful (to the student) "real" examples of these concepts and principles?

In point three, "meaningful" offers a stymie to all involved in communicating information. Obviously, an example which has a great deal of meaning for one student may have little for another. Experience and a rule of thumb tell us that the more probable the example is already known of within the repertoire of the student, the more likely the meaning will be transmitted.

At this point we are ready to consider the media form and transmittor of the selected examples. In the procedures trials, the investigators were much in the dark regarding applicable principles, when given certain specified teaching examples to represent requirements. The remaining section of this chapter discusses problems in terms of the media specialists' role.

The Media Specialist

Given that some instructional materials will be necessary to most effectively and efficiently attain the learning objectives that have been specified, how is the instructor aided in determining the materials to be located, selected, produced, and used?

At many universities, an audiovisual center has been established which has as part of its function the role of assisting faculty members to secure and successfully use various types of instructional materials. In recent years, the invention and development of new forms of recording, storing, retrieving, and displaying information has grown to such proportions, and at such a rate, that several specialties have developed within the field of audiovisual education. As a result, at institutions of higher learning where the use of media has received some prominence, it is not unusual to find the following specialists working as part of an instructional media or audiovisual center, or as part of a somewhat broader-based organization called a learning resources center.

Learning Resources Specialist:
Knowledge about materials, sources, cataloging, storage and care, and retrieval processes.

Graphics Specialist:
Skilled in design and production of charts, slides, transparencies, photos, and displays.

Film Production Specialist:
Skilled in design and production of educational films.

Instructional Television Specialist:
Skilled in producing instructional television programs.

Distribution Specialist:
Skilled in audio and video distribution systems and in the capabilities of all types of display equipment.

In some instances and with probably growing frequency, we find three additional types of specialists:

Programmed Instruction Specialist:
Skilled in design and writing of programmed materials.

Media Specialist:
Knowledgeable in all of the above specialties and in instructional theory and practice, as well as in curriculum development techniques.

Research Specialist;
Knowledgeable in research methods and the media field.

Assuming the evaluation and instructional specialists were able to assist the instructor in analyzing his instructional needs, one of these media specialists now assists the instructor to obtain instructional materials for use in a particular course or segment of the course.

The investigators hypothesized a number of general procedures for the media innovation phase of the instructional development process:

1. Statements concerning inputs, objectives, examples, and strategy decisions made to date are given to the media specialists by the instructional specialist.
2. The learning resources specialist is called upon first to suggest materials that are available which may serve as exemplars for the course.
3. A conference is held to establish communications among all the audiovisual specialists, and the instructor. Another approach may involve transmittal of requests to each audiovisual specialist in order that their specialty is required.
4. Decisions are reached as to materials and equipment needed for the specified teaching examples.
5. Commercially available materials are secured for instructor's approval.

6. Unavailable materials are designed, produced, and approved by the instructor.

7. Materials are tried out on representative students, evaluated, and revised if necessary. A specialized experimental classroom would be desirable for this purpose.

8. The instructor "practices" with new types of equipment and materials.

9. All materials and equipment are assembled for a "dry run" with a selected group present to evaluate, to trouble-shoot, and to smooth out the operation. If possible, this trial should be held in the actual classroom setting.

10. Any flaws detected in this trial are remedied.

11. Ready materials and equipment for classroom implementation.

The specialist-based model for instructional system development used in this study restricts the decision area of the media specialist more than is the usual case for audiovisual workers. Investigators hoped this limitation would serve to underscore the functional principles with which the media worker operates.

However, preoccupation with purely media selection decisions is a luxury seldom allowed audiovisual workers. Presently, they are expected to advise on a broad spectrum of communication problems, ranging from learner motivation to routine maintenance of graphic arts materials inventory. This diversity in their jobs make it difficult to pinpoint media decisions.

The identification of media decisions is blurred also by overriding administrative decisions. For instance, at times there is such preoccupation with the low distribution costs associated with television, that its shortcoming, lack of learner feedback capabilities, is overlooked.

Media specialists appear to be guided by two sources of information in advising the selection of any given representational form or transmission means. They are: (1) the findings of basic research in psychology of learning and communications, and (2) their own experience with problems of media production and utilization.

Observations of media specialists at work indicate a majority of their decisions are made in response to their experience rather than findings in the field of learning research.

This observation does not reflect negatively on the competencies of media specialists. The complexities and contingencies associated with teaching situations and learners make it unlikely that media decisions can be based on principles of communication and learning in their present form. More likely, decisions will be based on "functional media principles" derived from experience with actual production and implementation problems.

Instructional media decisions lean heavily on an intuitive connection the media specialist is able to make between his experiences and a given problem. Making consistently appropriate connections constitutes a competency to which most media specialists aspire. These observations have been made before in the audio-visual field, but appear to be the conclusions elsewhere as well. Krathwohl (74) observes:

> We do not have enough psychological knowledge for the teacher and the developer of instructional materials to move with certainty from an intermediate-level objective to a single set of very detailed and concrete objectives. . . .both the instructional material specialist and the teacher precede the psychologist into an area of most-needed research. They must make choices while the psychologist is still developing the knowledge to help them.

Consistency in making effective media decisions is handicapped by a shortage of learning research findings applicable to teaching situations. Also, there is little information on workable media development procedures for implementing what we already know about learning.

The attention psychologists are giving the instructional media area is best exemplified by Robert Travers in hi' recent USOE study. The conclusions of that investigation seriously question the psychological soundness and "theory" underlying current recommended practices in the audiovisual field. This comprehensive, if somewhat scathing, analysis measures commonly employed media use generalizations versus findings from psychological and communications research studies. The conclusions of that study hold out little immediate help for the media specialist.

> This (i.e., analysis of conditions affecting the learning process) does not mean that the work of the psychologist is directly applicable to the solution of problems faced by the audiovisual expert; for the psychologist, in the tradition of experimental science, studies phenomena in highly simplified situations. The problem of generalizing from these restricted and simplified situations to the complex situations of daily life is one faced by every scientific area.

The current limited usefulness of basic research is repeated later in the same report and an observation is made with regard to media specialists:

> This notable point of contact between the audiovisual area and the area of psychological research may represent a point of departure for extended research related to the design of audiovisual devices.

The "point of departure" reference made above should have special significance for those concerned with defining the media specialist's role. It suggests that the audiovisual field concentrate its energies in an area of intermediate level research. There appears to be need for a plan to locate functional media principles by sifting the practices employed by successful media specialists. This kind of an effort would involve several stages and perhaps more agreement among specialists than anyone has a right to expect. However, since a consensus is sought for descriptive, not prescriptive, purposes, it may be feasible. The proposed investigation would involve first establishing a model depicting the standard sequence of media development procedures. Second, specific practices of media decision and rationale would be solicited from media specialists, consolidated into a code of practices. To this end, some new taxonomy might be developed, or perhaps one already in existence could be employed. The third stage would consist largely of disseminating these findings for field testing and revision by practicioners and basic researchers.

The search for a theoretical or at least a functional structure to support the media specialist's role, deserves increased scrutiny and investigation, and soon.

Summarizing this portion of the discussion, it was pointed out that the media specialist's role, as it is presently practiced, attempts to cope with far too broad decision areas. When he is confined to purely instructional media selection decisions, there is little appropriate learning research to guide him. In the absence of counter arguments, the hard practicalities of cost and production tend to prevail in media decisions. It is suggested, as an interim step, to establish functional instructional media guidelines through a codification of current successful media selection and use practice.

Course Development Simulation

There are appreciable limits to the general ability of course development designs derived from the analysis of past events and inference from the literature of instructional research. From the beginning of the study, the investigators were aware of the deeper aspects of decisions associated with course development, and felt that media innovation process could truly be revealed only through first-hand observation and, if possible, manipulation of events. Certain funds in the study grant provided the opportunity to support a limited amount of media innovation in several courses, and fairly comprehensive work in two courses; Theatre Arts 142 and Electrical Engineering 413. The balance of this discussion section is devoted to a review of the details of the hypothetical development model trials in these two subject areas.

Theatre Arts Course Analysis and Media Innovation

Prior to commencing work with the theatre arts faculty members in the trial of the hypothetical model, investigators suspected that each step likely consisted of fairly complex decision-making. This suspicion was verified in listening to audio-tape of encounters between the team of specialists and the two instructors responsible for the theatre arts course. This complexity made the analysis of course content and behavior objects extremely time consuming and taxed the ingenuity of the study staff to come up with the kinds of questions to uncover this information and forms on which to record it. The instructors often expressed second thoughts , once their statements of course objectives and content were committed to paper. This is not necessarily a sign of indecision on the instructors' part. Stating objectives and content in written form appears to make the instructors more aware of the conditional nature of their decisions on what and how to teach. They wanted to be sure they had done their best.

The instructor needed more information on the needs of the student who enrolls in the course. Throughout the development discussion, the specialists found themselves playing the role of a representative student. In the absence of another party to test reactions, instructors appear to test teaching plans on an idealized student they construct from experience. Obviously, the veteran professor has more opportunity to shape his representative student than the graduate teaching assistant or new instructor, who usually uses himself as a model.

It would be extremely helpful if sample groups of the student population could be established at universities on which innovation could be tried prior to its implementation in actual courses. Perhaps, an experimental classroom could also be constructed to aid in simulating course instructions, comparable to the "test track" or "market testing" approach in product development.

This is a response of one of the theatre arts professors to his work with the evaluation specialist in identifying objectives:

COMMENTS ON THE DAY'S DISCUSSION

June 16, 1964
Dr. E. C. Reynolds

I am dictating these from the top of my head. I hope they will be valuable. As I mentioned to Leroy yesterday morning, I am not sure exactly that we are yet in a position to know whether or not we have accomplished anything. My general reaction to the discussion was that it helped me to organize my own thinking about the course. We had some difficulty fitting ideas into the grid, but I rather think this is the nature of the beast (Theatre Arts 142) rather than the grid. Also, this may say something about the use of the grid for this particular kind of course. So far, quite satisfied and I assume I will be asked for further reactions later.

The "grid" or matrix device (Figure 9) was used by the evaluator to collect information on course content and learner behavior goals. In contrast, the course syllabus, see Figure 13, confined itself only to content and time continuum.

Figure 13

Speech 142
INTRODUCTION TO THEATRE

Text: Hatlen, Theodore, Orientation to the Theatre, Appleton, Century and Crofts
Play Texts: Four Modern Plays, Holt-Rinehart
Death of a Salesman, Viking Press
Medea and Other Plays, Penguin Classics

Date	Topic	Assignment
10-2-64	General Introduction	Medea
	The Fundamentals	
10-5-64	No Conflict - No Drama	Pref. Chpts. 1 & 2
10-7-64	Motivation - The Basis of Understanding	
10-9-64	The Audience	Chapter 15
	Theatrical Forms	
10-12-64	Tragedy: The Serious Drama	Chpts. 3 & 4
10-14-64	Melodrama: The no so Serious Drama	Chpt. 5
10-16-64	Comedy: High, Low, and Inbetween	Chpt. 6

Oct. 19	Musical Comedy - To Oklahoma!	Hedda Gabler
Oct. 21	Musical Comedy - Oklahoma! and After	
Oct. 23	Medea Lecture - Frank Rutledge, Director of Theatre Production	
Oct. 26	The Absurdist Drama - How Absurd?	
Oct. 28	Dramatic Criticism	
	The Physical Theatre	Pygmalion
Oct. 30	The Form of the Theatre	Chpt. 14
Nov. 2	Style in the Theatre	Medea Review Due Chpts. 8, 9, & 10
Nov. 4	Style in Production	Chpt. 13
Nov. 6	MID-TERM EXAMINATION	
Nov. 9	The Arena Theatre vs Proscenium Theatre	
	Theatre Production	
Nov. 11	Acting - What It Is	Chpt. 12
Nov. 13	Acting - Demonstration	
Nov. 16	Direction - What It Is - (Function)	Chpt. 11 Emperor Jones
Nov. 18	Directing Procedures	
Nov. 20	Fantasticks Lecture - Smith	
Nov. 23	Guthrie Lecture	Death of Salesman FANTISTICKS Nov. 19-24
	Problems of the Mass Media	
Nov. 25	Whatever Happened to Radio Dramas	
Nov. 27	Orson Welles - War of the Worlds	
Nov. 30	Television - As a Form for Drama	
Dec. 2	The Commercial Theatre	

THANKSGIVING RECESS. THURS. - NOV. 28 - SUN, DEC. 1.

Dec. 4	The Educational Theatre - How and Why
Dec. 7	The Future of Educational Theatre Final Class and Review Period

MON. - FRI. DEC. 9-14 FINAL EXAM PERIOD

The matrix proved exceptionally useful to the instructor for producing specific statements of course objectives and linking these objectives to subsequent judgements on appropriate media usage.

A sample of the initial analysis conducted in the theatre arts development simulation is shown in Figure 14 .

Figure 14

CONTENT - BEHAVIOR MATRIX	CONTENT			
ACTION	ASSOCIATION	CONCEPTS	PRINCIPLES	STRATEGIES
RECOGNIZE REORGANIZE	Play Titles Authors Dates	Realism Naturalism Expressionism Impressionism Kinds of Contemporary Theatre Blocking Business	Realist took positive attitude and tried to provide solutions. Naturalism depicts life and its suffering with no solution. Expressionist tries to objectify life by using scenes, etc. Impressionism tend to elicit emotional reaction. Method - directorial principles design principles	
RECALL LIST	Historical Developments in the Physical Theatre.		Comedy - Domestic High - distinguished by verbal wit Farce - depends upon physical action	
TRANSLATE CONDENSE EXPAND		Apply concepts to - radio - television - contemporary Write essay or expand on types or styles.	Reduce theatre to a man and his environment.	
INFER DEDUCE INDUCE ANALYZE SYNTHESIZE EVALUATE APPLY	From knowledge of dates, infer development of theatre.	Analyze play in terms of elements of a style. Example - realism Structure - exposition, inciting action, building conflict, climax, resolution. Direction - interpretation. Acting - technique, movement.		Apply strategies to a production.
CREATE				Theme - what the author had in mind. Style - most film is realistic. - how to classify the comedy; give illustrations of type of comedy. Personal Evaluation - Overview of acting - Direction depends on camera and editing.

Despite its usefulness in the statement of objectives and identification of instructional tasks suited to media, the matrix contributed little toward devising an optimal sequence of content presentations for learner behavior development, essentially instructional strategy. To this end, the instructional specialist asked the instructor to review his objectives and state the most complex behavior sought from the learner. This resulted in a heirarchy of hoped-for behavior.

LEARNER BEHAVIORS - THEATRE ARTS 142

Most complex behavior:

Critically Review a Play

Major subdivision of complex behavior:

Analyze Play

Next levels of behaviors:

1. **Recognize the literary elements contributing to theatrical excellence. (including 2 lectures on elements of conflict, motivation, audience behavior.)**
2. **Distinguish between dramatic types.**
3. **Distinguish dramatic styles within types.**
4. **Relate the physical form of the theatre to its historical background.**
5. **Distinguish between good and poor plays.**

Judge Play's Worth

Next levels of behaviors:

1. **Distinguish dramatic styles within types.**
2. **Distinguish between good and poor plays.**
3. **Recognize contributions to the play by skill areas in theatre.**

The instructor judged the preceding sequence of behavioral outcome as optimal for achievement of the most complex behaviors. In the outline, the instructor notes that while one set of behaviors (1 through 5) contribute to "Analyze Play," some of these same behaviors also build the ability to "Judge Play's Worth."

The instructional specialist made several attempts to correlate the sequence of content to the behavior sequence suggested by the instructor. Figures 15 and 16 illustrate the format used. Whereas, specification of a sequence of steps for behavioral development appears possible, little progress was made on determining an optimal order of content presentation.

An interesting question raised by this experience is whether an optimum sequence of behavioral outcomes is consonant with the content presentation prescribed by advocates of the "structure of knowledge."

Failing in efforts to perceive a structure of content on which to base a new presentation sequence, the planners accepted the sequence of the existing syllabus.

The instructor next proceeded to work with the media specialist. Media decisions deal primarily with what representation of examples appears to be necessary and what media forms should be employed.

Media decisions must be sensitive to a number of factors, including the style of instruction which has proven successful in the past, and with which the instructor is willing to "live," The instructors were willing to listen to instructional alternatives to lecture, such as film, etc., if a case could be made for them. The media specialist reviewed the content outline and behavior objectives statements developed earlier by the instructor and instructional specialist. Referring to both the rationale offered by the content-behavior matrix and his own repertoire of experience, the media specialist either suggested no change in teaching or specified certain newer media forms. Figure 17 illustrates a form used in this step.

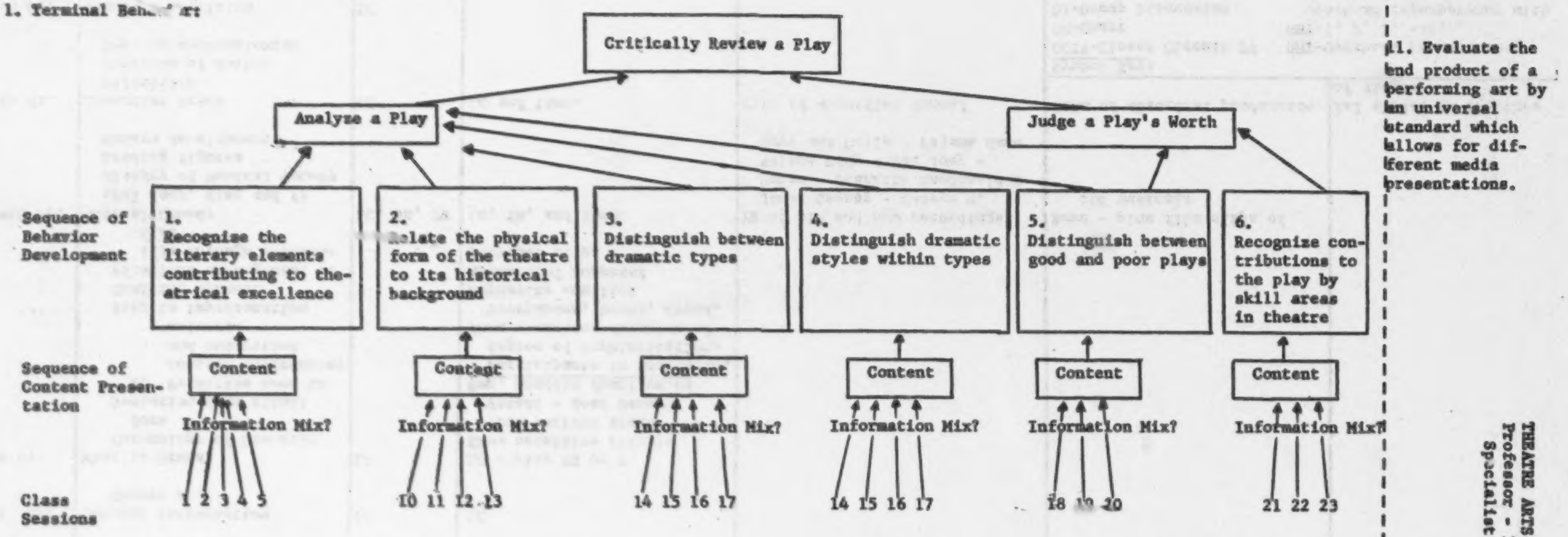
Recommendations for implementation of newer media introduced the participation of media persons best termed production specialists; namely, graphic artists, film producers, photographers, television technicians, etc.

Since most educational institutions are limited in the media production facilities they can maintain, an important question at this point is, "Does the devised material already exist in the form and quality desired, and is it cheaper to buy than produce?" In a specialized field such as theatre arts, this was a hard question to answer. For instance, the following filmed plays were recommended for course use:

Figure 15

DESIGN FOR RELATING CONTENT TO BEHAVIORAL ANALYSIS

1. Terminal Behavior:


Critically Review a Play
Analyze a Play
Judge a Play's Worth
11. Evaluate the end product of a performing art by an universal standard which allows for different media presentations.
Sequence of Behavior Development
1. Recognize the literary elements contributing to theatrical excellence
2. Relate the physical form of the theatre to its historical background
3. Distinguish between dramatic types
4. Distinguish dramatic styles within types
5. Distinguish between good and poor plays
6. Recognize contributions to the play by skill areas in theatre
Sequence of Content Presentation
Content
Content
Content
Content
Content
Content
Information Mix?
Information Mix?
Information Mix?
Information Mix?
Information Mix?
Information Mix?
Class Sessions
1 2 3 4 5
10 11 12 13
14 15 16 17
14 15 16 17
18 19 20
21 22 23

THEATRE ARTS
Professor - Instructional
Specialist Encounter

Figure 16

THEATRE ARTS
Professor and Instructional
Specialist Encounter

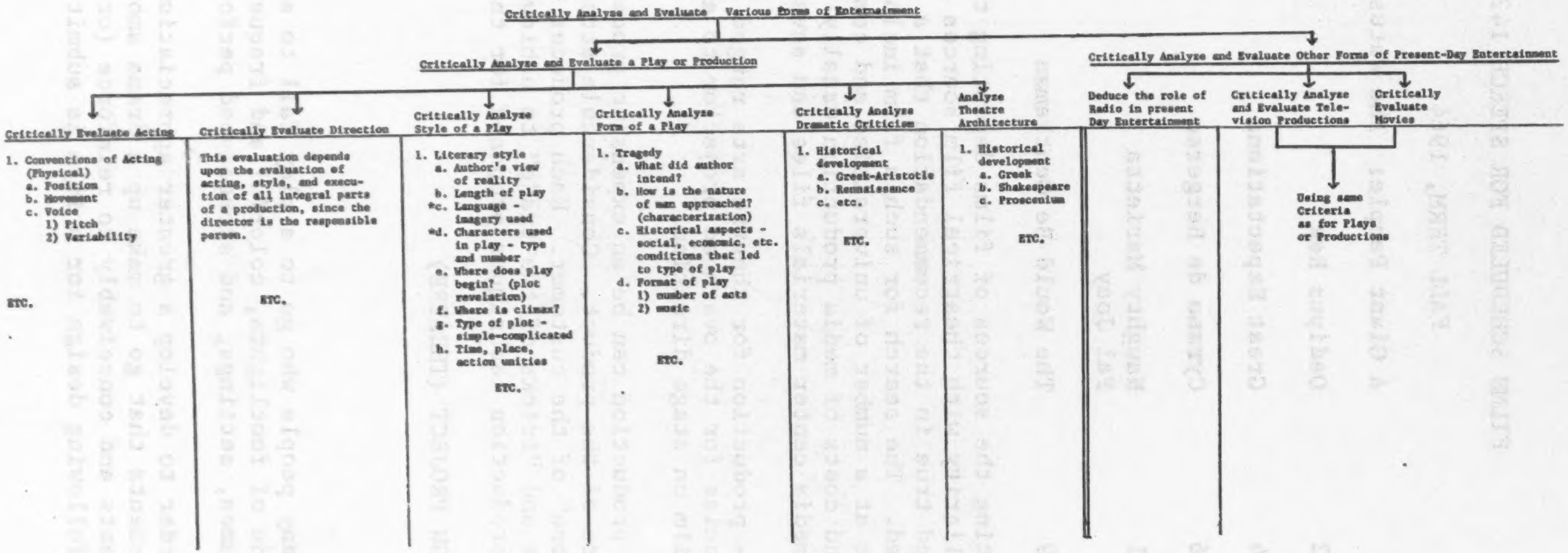
CONTENT AND INSTRUCTIONAL PROCEDURES ANALYSIS FORM

Time Allotment	Content Outline	Present	Preferred	Available	Suggested	Production Needs
1st Hr.	General Introduction Course req.	LC	LC			
2nd Hr.	What is Drama: Chronology of Dramatic form Evolution from ritual 1. Primitive need to control environment and understand universe Step to impersonation Conflict element Vicarious enlargement of life through ovservation	LC	LC - plus FS or S Show primitive rituals from various areas Watusi - Bear Dance? Emp. mimetic function of participants in increasing degree of sophistication. Show vicarious function of newspapers, books, drama. Emphasize conflict Animation? Puppets? Newsreel clips -			
8-9th Hr.	Musical Comedy (Pal Joey, King and I) History of Musical Comedy Leading figures Modern developments	LC, DR, TR	LC, TR, and 16mm.	TR of old and new recordings James Cagney - George M. Cohan - Jeanette MacDonald & Nelson Eddy - Pal Joey - Guys and Dolls - Pajama Game	Same - plus film clips of old musicals	
10th Hr.	Absurdist Drama Definition Function of Author Debt to expressionism	LC	LC and 16mm.	Film of absurdist drama?	Film of absurdist production.	2x2 slides on sketches of stages
11th Hr. 12th Hr	Dramatic Criticism " " Implication of scientific thought	LC				
13th Hr.	Form of Theatre - Architecture	LC & S	LC, S, OHT?, 1,2,3	Showing ground plans of theatres through various periods of drama-would have to be through conference w/ instructor		

Symbol Key:
CCTV-Closed Circuit TV
CH-Chart
DI-Group Discussion
DR-Disc recording
FB-Felt Board
FS-Filmstrip
LC-Lecture
LD-Live demonstration
MO-Model or mockup
MP-Motion picture
OHT-Overhead transparency
OHT-1, 2, 3, etc.
Overhead transparency with 1,2,3, or more overlays
OP-Opaque projection
PI-Programmed Instruction
S -2x2 slides
TR-Tape recording
8mm-8 millimeter film
16mm-16 millimeter film

Figure 17

BEHAVIORAL GOALS OF INTRODUCTION TO THEATRE


Critically Analyze and Evaluate Various Forms of Entertainment
Critically Analyze and Evaluate a Play or Production
Critically Analyze and Evaluate Other Forms of Present-Day Entertainment
Critically Evaluate Acting
1. Conventions of Acting (Physical)
a. Position
b. Movement
c. Voice
1) Pitch
2) Variability
ETC.
Critically Evaluate Direction
This evaluation depends upon the evaluation of acting, style, and execution of all integral parts of a production, since the director is the responsible person.
ETC.
Critically Analyze Style of a Play
1. Literary style
a. Author's view of reality
b. Length of play
*c. Language - imagery used
*d. Characters used in play - type and number
e. Where does play begin? (plot revelation)
f. Where is climax?
g. Type of plot - simple-complicated
h. Time, place, action unities
ETC.
Critically Analyze Form of a Play
1. Tragedy
a. What did author intend?
b. How is the nature of man approached? (characterization)
c. Historical aspects - social, economic, etc. conditions that led to type of play
d. Format of play
1) number of acts
2) music
ETC.
Critically Analyze Dramatic Criticism
1. Historical development
a. Greek-Aristotle
b. Renaissance
c. etc.
ETC.
Analyze Theatre Architecture
1. Historical development
a. Greek
b. Shakespeare
c. Proscenium
ETC.
Deduce the role of Radio in present Day Entertainment
Critically Analyze and Evaluate Television Productions
Critically Evaluate Movies
Using same Criteria as for Plays or Productions

September 17, 1964

FILMS SCHEDULED FOR SPEECH 142

FALL TERM, 1964

October 5	A Giant People: The Watussi	2 minutes
October 12	Oedipus Rex	88 minutes
October 14	Great Expectations	1st scene
October 16	Cyrano de Bergerac	Scenes to be selected
October 21	Naughty Marietta Pal Joey	Scenes to be selected Scenes to be selected
November 9	The Would Be Gentleman	95 minutes

Locating the sources of films depicting these plays called for long-term familiarity with theatrical film sources and use regulations. The same proved true in the recommendation that a film on stage direction be employed. The search for such a film included a survey of unpublished film lists at a number of universities and commercial agencies. The time, effort, and costs of media production usually warrants the search efforts. Complete media center materials files can save money.

Media production for theatre arts ranged from relatively inexpensive transparencies for the overhead projector to an original 20 minute motion picture film on stage direction.

Film production can be an expensive process, depending on the customized nature of the product. Considerable attention is given to achieving the "purpose" of the customer. Each producer brings to the task his experience and "tricks of the trade" to achieve effectiveness, as witness the film production techniques proposed for the theatre arts case.

FILM DESIGN PROJECT (THEATRE) Barson. . . .Job #264

PURPOSE

So many people who go to a play fail to see beyond the mere facade of footlights, colorful and frequently extravagant costumes, settings, and stereotyped performances of the players.

In order to develop a greater appreciation of the theatrical increments that go to make up a drama among the non-major drama students and conceivably to reinforce (orient) the drama major, the following design for a film is submitted.

SPECIAL CONSIDERATIONS AFFECTING THE DESIGN

A form following a five-in-one design is suggested. These six short-format presentations to be introduced overall by animation or "live" photography illustrating points "what a play is" and "what a director is."

Looking deeper into the increments of the play, each of these to be presented in short format, are: the READ THROUGH, MOVEMENT, COMPOSITION, BUSINESS, and TECHNOLOGY. The FINISHED PRODUCTION can possibly be used as an effective recap or summary device. The instructor will then have the option of showing the film in its entirety, or showing the portion therein which may apply explicitly to his lecture of the day.

Color is suggested to carry more effectively the sets, costumes, and lighting elements of the production.

A "pixillation" or "live" animation technique is suggested in covering the increments of MOVEMENT and composition.

The development of all five increments will possibly require lip-synch coverage. Two cameras, requisite for effective inter-cutting, will be used.

As discussed with the theatrical consultants, actors are to be introduced before the cameras "raw;" that is, unrehearsed. This approach should provide a certain freshness and possibly more effective development of the chosen scenes.

We should attempt to find some analogy device to carry the idea of what a play is and how the increments are coordinated by the director into a whole. It has been suggested to date that a spinning color wheel be used to build up this analogy. But let's keep looking.

The question that always faces a film maker, whether to use his camera cinematically or as a documenting instrument, like-wise must be considered here. I feel that we should not let this hamper our work. . . .use it as it is needed. I suspect there will have to be a combination of both uses. . . .covering the play from the theatre audience point of view but also moving in to cover effectively such secondary movements and business as is deemed necessary.

Here follows a rough synopsis of the film as I see it to date:. . . .

In addition to the decisions on major production strategy questions, production problems cover many minor but important issues, such as the difficulty in projecting the color of a thin line on an overhead transparency, and the suggestion that the professor sketch his ideas on acetate during lectures. The sketching approach identified design specifications the instructor was earlier unable to verbalize.

The operation of media presentation devices introduced yet other technicians to the development process. They also require information in order to perform their functions. Is there a projection booth in the classroom? What is the projection distance available? Since the commercial films cannot be cut, is there room for two projectors using pre-marked reels to present film excerpts? Is the classroom occupied prior to the theatre arts course?

The intercommunication of the various participants in the development process strongly recommends the services of a development project coordinator who can oversee arrangements and forsee problems. It may be this task could be a function of the instructional specialist or, perhaps, a classroom-oriented media specialist.

Electrical Engineering Course Analysis and Media Innovation

Development experiences with the two instructors in electrical engineering closely parallel those in theatre arts; that is, the nature of the content did not require alteration of the analysis and development sequence suggested in the hypothetical model. It should be noted, however, that the engineering faculty were familiar with systems analysis and flowchart operation from its extensive use in their discipline. While this familiarity with the analysis technique shortened their orientation period, it did not appear to make their decisions on instructional strategy any easier than those in theatre arts.

Work between the evaluation specialist and instructors proceeded well, as witness the comment by an instructor and the evaluation specialist on a meeting for determination of effectiveness.

Instructor: H. E. Hedges

> Session ran smoothly -- seemed to be a fair amount accomplished. Not 100% confident on categorization of objectives.
>
> Two-hour session seemed about right -- long enough to get something accomplished, time goes rather rapidly, but yet any longer would probably overdo a good thing.

Instructional Specialist: John Gordon

By the end of August they will have definite word as to the number of students who will be taking the course. No teaching decisions, assignments, or room arrangements have been made as yet.

Possibilities for the course: Large group meetings for one or two sessions per week and then break up into smaller discussion-type groups for the remainder of the sessions.

Separate groups for each faculty member, with possible joint use of media materials.

Possible use of linear program on Matrix Algebra later on in the course.

Hedges really coming along: used term "terminal behavior" quite easily!!!!!!

Interestingly enough, the investigators discovered that the engineering instructors had already carried out a content analysis in the preparation of a staff-produced text for use in the course. See page 109-110.

EE252-P, Networks-Systems
Outline of Course Work, Fall Term 1963

Week of	Topics
September 26	Introduction to Systems Analysis, Relations Between Mathematics and Physical Systems, Intro. to Measurements and Instrumentation
September 30	Measurements, Through and Across Variables, Signals; Step Function, Exponential Function, Periodic Functions, Sinusoids, Rectangular Waves, etc., Average Value, RMS Value of Signals
October 7	Power and Energy Functions, Average Power, Fourier Series: Forms, Determination of Coefficients, Symmetery Properties, etc., QUIZ
October 14	Concept of Mathematical Models, Terminal Characteristics of Two-Terminal Components, Linear and Nonlinear Algebraic Models, Small-Signal Approximation, Piecewise-linear Approximations.

October 21	Sources, Active Elements, First-order Differential Equation Models of Two-Terminal Components, Frequency Response Characteristics.
October 28	Step function response, General Soln. of First Order Equation Models, Transient and Steady-state Solutions, λ (t)Variable, Elliptical Approximations.
November 4	QUIZ, Matrix Algebra; Definitions, Matrix Operations as Addition, Multiplication, etc.
November 11	Matrix Inverse, Partitioning, Rank, Elementary Matrices, Equivalent Matrices.
November 18	Matrix Algebra, contd., Solutions of Homogeneous and Non-Homogeneous Equations, QUIZ
November 25	Introduction to Mathematical Models of Multi-terminal Components, Associative Property of Measurements, Forms of Equations, Three-Terminal Components, Open-circuit Parameters.
December 2	Open-circuit, Short-circuit, Hybrid, Cascade Parameters for Three-Terminal Components, Transducers and their Mathematical Models.

The evaluation specialists thus worked with the instructor primarily to determine behavioral objectives associated with mastery of this content. The approach used was similar to that in theatre arts. Identify the most complex behavior and then establish the heirarchy of behaviors which contribute to learning. Below is a list of the major courses behavioral objectives and their components. Figure 18 illustrates a sequence the instructor and instructional specialist regarded as the best order of learner behavior:

BEHAVIORAL OBJECTIVES - ELECTRICAL ENGINEERING 413

Develop the ability to analyze descreet systems

A. Develop necessary mathematical skills

1. Gain facility in matrix operations
2. Apply mathematical characteristics of signals
    a. Sinusoidal characteristics, etc.
    b. Expand functions in a Fourier series for repetitive signals

B. Relate mathematical to physical systems through measurement

1. Electrical systems
2. Mechanical systems
3. Hydraulic systems

C. Develop mathematical models

1. Develop terminal equations and terminal graphs for two-terminal components

    a. Understand typical terminal characteristics

        1) linear and non-linear algebriac models
        2) first order differential equation models
        3) source or active element considerations

    b. Apply typical terminal characteristics

        1) electrical
        2) mechanical
        3) hydraulic

2. Develop terminal equations and terminal graphs for multi-terminal components

    a. Understand typical terminal characteristics

        1) linear and non-linear algebriac models
        2) First order differential equations
        3) source or active element considerations

    b. Apply typical terminal characteristics

        1) electrical
        2) mechanical
        3) hydraulic
        4) transducers

    c. Comprehend the Associative property of measurement in relation to

        1) open-circuit parameters
        2) closed-circuit parameters
        3) hybrid parameters
        4) cascade parameters

Figure 18

BEHAVIOR ANALYSIS		ELECTRICAL ENGINEERING Professor and Educationist Analyst Encounter
	Analyze discrete systems	
	Recall definitions of sets of multi-terminal Parameters	-- open-circuit measurement principles, etc.
Evaluation --	Recognize types of parameters	-- open-circuit, etc.
	Apply rules used to obtain other sets of parameters when one set is known	
	Evaluate mathematical model of multi-terminal systems	-- obtain values for parameters - are they in typical range?
	Analyze terminal characteristics mathematically	-- techniques for developing families of curves where a value may depend on more than one variable. (Associative property of measurement)
	Translate component characteristics into terminal characteristics	-- computational schemes of analyzing component characteristics -- matrix operations
	Evaluate physical component characteristics	-- measurement schemes of analyzing component characteristics (terminal graph)?
	Analyze physical multi-terminal component characteristics	-- information i.e. definitions of multi-terminal component characteristics
	Evaluate mathematical model of two-terminal components	small signal approximations
	Analyze terminal characteristics mathematically	techniques of developing linear approximations of non-linear characteristics
	Translate component characteristics into terminal characteristics	-- linear and non-linear algebraic differential equation
	Evaluate physical component characteristics	-- measurement schemes
	Analyze physical component characteristics of two-terminal components	-- definitions of two-terminal components
	Evaluate signal and select a mathematical form	-- set of rules or criteria
	Analyze signal plots	-- Recall commonly used signals
	Recall relation of mathematical models to physical systems	-- Types of measurement
	Recall nature of mathematical models	-- purposes of mathematical model - statement of physical conditions. Limitations

Just as in theatre arts course, the instructional specialists could offer little rationale to change the order of content presentation from that of the existing course outline. Accordingly, the syllabus sequence was passed on to the media specialist to recommend representational forms for the content examples.

The major media innovations in this course were: (1) preparations of overhead transparencies to improve on chalkboard illustrations; (2) a series of 8mm cratridge-loaded film clips of laboratory experiments to save orientation time in laboratory sessions; and (3) use of an electronie responder to test presentation clarity. It turned out that the responder provided valuable diagnostic help to the instructor. As it developed, most of the audiovisual materials were planned for use in the first third of the course.

The basic rationale used by the media specialist in recommending the various media types was that abstract concepts would hold more meaning if presented in visualized forms and in motion where appropriate. The media technicians were hard-pressed to create graphic illustrations previously represented only by equations. This task required close work with the instructor in order to be accurate in dimension, scale, and perspective.

The most complex production was the motion picture of laboratory measurements being made in three physical systems: electrical, mechanical and hydraulic.

The length of time needed for production of three 5-minute clips is illustrated in the production schedule, Figure 19. Production problems included a simplification of laboratory hook-up materials to offer a clear photographic image in the parts in the laboratory experiment devices. Tubing lengths were shortened, wires coded, and equipment parts highlighted with flood lights in order to clarify the process being tested.

The production period was prolonged by technical errors in the commercial transfer of the 16mm laboratory film to the 8mm cartridge format. Following the film producer's objections to the off-color and off-center defects, the company reprocessed the films correcting the errors. This experience is cited to point up the importance of competence at each level from the initial instructional analysis to materials procurement and implementation. The recycling or repetition of decisions, due to faulty judgment, adds considerable time to the development process.

The development work in the engineering course differed from theatre arts in the amount of time required for the various steps. The engineers moved through the objectives analysis steps more quickly than the theatre group, but conversely requiredconsiderably more time in translating their concepts to the media production technicians.

Figure 19

PRODUCTION SCHEDULE . . . . . . ENGINEERING SHORT FORMAT FILMS

August

7	Storyboard work started

September

16	Research
17	Conference and script
18	Script and storyboard
19	Script
20	Script and storyboard
21	Begin animation art Revise sound track, MSU #5
22	Live shooting Short format
23	Complete live shooting Mail out
24	Animation art completed and shooting
25	Animation art compmeted and shot ... mail out
26	
27	
28	Begin second series of short formats
29	Original color footage back from laboratory
30	A and B roll editing

October

1	A and B roll edit - mail out
2	
3	
4	
5	Lab makes up colog interneg from A and B rolls
6	Reduction to 8mm and capsuled
7	
8	
9	Receive prints for preview and use
10	

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

Many of the conclusions reached in this study already have been stated in the descriptions of the results of course development analysis and procedures trials. The investigators elect to offer in this report chapter several guidelines based on the reported findings and applicable to the concerns held by college course developers and media innovators. In addition, they present recommendations for further refinement of the guidelines.

Administrative Organization for Media Innovation and Instructional Development

It is advisable to physically centralize the facilities for media innovation and instructional development in college courses. The time, personnel, and financial resources needed for major revisions in teaching materials and methods cannot be spared from typical department teaching budgets.

The establishment of a learning resources center, instructional development center, or whatever the teaching resources agency may be called, is essential to the strategic channeling of major institutional funds into the effective improvement of courses.

There is little reason to standardize the model for the administrative organization, rather it is desirable to pattern its growth to fit the size, policies, resources, and other limitations of the institution involved. Almost any organizational structure is useful, if it permits the necessary instructional development procedures to occur unhampered.

The staffing of the development organization should make available to faculty members and academic departments the services needed for analysis of instruction and implementation of teaching materials. It is likely these competencies are best obtainable through the employment of specialists in three areas; evaluation, instructional design, and media. In addition to specialists, the services of a coordinator appear useful to expedite the progress of the development process.

There remains considerable speculation regarding the nature of relationship the instructor and the academic department will accept with a centralized development agency. It is suggested that further investigation be conducted to determine the feasibility of training substantive academic personnel in the specialties of teaching analysis and materials design as a means of bridging this gap. This approach is judged more practical than attempting the training of the learning specialist in the subject.

Standard Procedures for Media Innovation and Instructional Development

Improvement in methods of instruction has been traditionally delegated to the instructor by higher institutions without providing him much recourse for assistance changes in enrollment, content, and objectives may demand. The only alternative available to many professors is to imitate the teaching methods by which they learned or they observed in use by colleagues. The cases of problem-solving approaches to instructional improvement observed by the investigators were directed by faculty members who fortunately possessed analytic skills and the ability to garner needed resources. The steps of change varied in sequence and efficiency among cases, but not in kind. It is desirable for media innovators and course developers to know the kinds of decisions they are expected to make, even if the "correct" alternative cannot be specified. It is also helpful to provide the instructor with the expertise of trained and experienced specialists to assist him in considering the value of alternatives and recommend resources of which he is not aware. The flow chart model of instructional development procedures offered by this study is useful in merging the talents of instructors and specialists to the end of making practical decisions for innovating media in college courses.

The limitations of this model is the possibility that the solutions to instructional problems may not be within the capability of media. It is likely that this model in reality is merely a part of a broader scheme of instructional development. This probability should be investigated. Also, the communication gap among various specialists working with the faculty member should be studied for the possible development of a common taxonomy or language. Other major problems of the defined development process deal with sequence of steps and the competencies of the specialists. Unfortunately, the most logical step for commencing instructional improvement, the analysis of objectives, is also the most traumatic. Some further study should be carried out to make this initial process less troublesome. There also remains the major questions as to how critical is the competnecy of the specialists in aiding the instructor to make effective changes in teaching. The heavy reliance placed on experience by specialists in this study, raises the question as to what can be done at an institution which has little history of media innovation or hires an inexperienced staff.

The Role of the Specialists in Procedures of Media Innovation and Instructional Development

Faculty members involved in the study generally praised the usefulness of development steps in terms of the assistance provided in each by the development specialists, despite the handicaps under which these specialists worked. The specialists were designated such by the investigators to test out their ideas on course development process. Persons with some of these competnecies exist on most campuses, but seldom are harnessed to aid faculty in solving teaching problems. Often their major role lies in teaching courses in their specialty or supervising research. It is timely to search out these persons and invite their participation in course development work. The experience in this study is that faculty members in the various disciplines are receptive to this assistance when it is introduced as a decision among alternatives on which the faculty member retains final approval power. This arrangement places the key responsibility on the specialist to construct as valid a case as possible for his proposals. Sure-fire guarantees of success are not necessary for proposal acceptance. Frequently, instructors will settle even minor gains in teaching effectiveness.

The general lack of scientifically supportable theory forced all three of the specialists recommended in this study to draw heavily on experience and rule-of-thumb or heuristic guidelines in the advice they offered instructors.

The evaluation specialists' work in this study points up the uncertainty instructors have about discussing their subject in terms of learner-behaviors concepts and teaching examples. It appears desirable to have the instructor develop statements of curricular aims with colleagues in terms meaningful to them before attempting instructional analysis. Stating objectives in written form usually creates an awareness in the instructor of the conditional nature of teaching decision and a concern that his method and materials be appropriate to develop desired learner behavior. Instructors find it easier to follow the analysis if the specialist works from final behavior backwards to the entry behavior of the learner.

The work of the instructional specialist points up how few principles are available to relate teaching strategy to stated objectives. It is not clear whether an inherent structure of knowledge or sequence of learning behaviors is more useful in designing instruction. Either approach is an overwhelming task when attempted on a whole course. It is better to work in smaller units. This specialist can offer assistance in perhaps the most critical decision the instructor makes in developing instruction; that of choosing the examples for the subject matter. Most often the best example is that which lies within the students' repertoire or background. The ability to choose a good example is the creative act which marks the excellence of an instructor. This is the art of teaching. No quality of presentation in method or media can overcome the handicap of an inappropriate example.

The past history of the work of media specialists suggests that they have been asked to make decisions regarding instruction better directed to others. They have shouldered these concerns in part due to the indifference of other specialty areas toward practical application of knowledge to teaching, and partly in quest of more precise specifications to guide preparation of instructional materials. Even with the prior problem analyses made possible by the assistance of evaluation and instruction specialists, it would be helpful to the media

specialist if materials could be tested on representative students before implementation in courses. An experimental classroom for general methods testing is suggested. The assistance of an experienced media specialist offers savings in time and costs of instructional media production and implementation.

Recommendations for Further Research and Development

The investigators suggest five high-priority areas for further study to advance the practice of instructional development and media innovation.

1. **Test instructional development procedures in various university settings to determine the feasibility and reliability of the plan evolved in this study and refine its steps.**

2. **Identify heuristic principles or "workable" approaches available to the evaluation, instruction, and media specialists in their work with instructors and teaching problems.**

3. **Build a research-hypotheses-generating mechanism into the course development procedures to identify unknowns particular to this process and make possible more integrated and applicable research.**

4. **Explore the nature of substantive programs of preparation for specialists in instructional design and media application to teaching.**

5. **Disseminate the findings of successful media innovation and instructional development to broaden the base of these efforts and deliver their benefits to more universities and colleges.**

CHAPTER VI: SUMMARY

The long-predicted increases in university enrollments, coupled with spectacular advances in all fields of knowledge, have literally sent educators to the drawing boards to improve modes of instruction. The newer media of communications are among the most radical teaching changes instituted. Success at one institution after another has resulted in varying degrees of usage at most universities. Despite this success, little investigation has been conducted in determining optimal media innovation procedures, and for that matter, the real costs of media implementation. The report that precedes this chapter describes the activities and findings in Part A of a two-part investigation which explores media innovation in instructional development and its associated costs.

The overall study project had four specific purposes: (1) to do a descriptive analysis and evaluation of instructional development activities at Michigan State University during the period 1963-1965; (2) to devise methods of measuring costs associated with instructional systems development and to develop principles of sound budgetary planning for the use of educational media in university instruction; (3) to develop hypothetical models of instructional systems development procedures and their relative costs and, (4) to prepare descriptive reports of the above materials for use by other institutions of higher learning concerned with the application of technology to instructional programs.

The tracing of successful media innovation in courses at Michigan State University was conducted in an attempt to identify effective steps of instructional development and patterns of administrative organizations. The administrative developments which appeared to be most significant were;

1. Recommendations of a faculty study committee that an audio-visual center (now known as the Instructional Media Center) be established to replace the decentralized media facilities which served and were located within various academic departments.
2. The employment of a professional educator to organize and operate the audiovisual center on the premise that its primary purpose is to improve instruction.
3. The establishment of closed circuit television facilities to improve instruction for and accommodate a large increase in enrollment.

4. The conception of the Educational Development Program, a University-wide funded effort to assist academic departments solve general and specific instructional problems.

5. The merger of the Audiovisual Center and the Closed Circuit Television Department for more efficient operation as a centralized Instructional Media Center.

6. The institution of course development work on a shared responsibility basis among the Instructional Media Center, Office of Evaluation Services, and a newly established Learning Service. This consort of agencies operates as the Instructional Development Service under the guidance of the Educational Development Program.

The investigators analyzed eleven different courses of instruction in which media innovations have been introduced in an attempt to identify key development steps. These were traced in sufficient detail to warrant reporting the sequence of development events and assessment of their effectiveness. Several common development aspects were observed in all eight cases examined:

1. A common benefit ascribed to the use of media was that of providing a greater uniformity of instruction (a commoness of experience). In the case of classes with large enrollments, this was considered desirable since it permitted those with major responsibility for the courses to be more certain of what was actually taught. Also, it permitted the use of a common final examination, which could be corrected and further analyzed by the Office of Evaluation Services.

2. In most cases, course innovations involving the newer media originated outside of the departments which developed and refined their use. The media techniques and content decisions were a product of joint decisions by faculty members and media specialists.

3. The assistance given to departments and faculty by media specialists, and in some cases evaluation specialists, was extensive and readily accepted by faculty members.

4. A considerable amount of time is required for the instructor and the media specialists to establish a common understanding of content and techniques necessary for efficient communication. Teaming up on a second or third project for a given combination of instructor and specialist probably requires less man-hours than the first venture. Any measures which would shorten this "getting to know each other" period would improve the efficiency of the procedures. The use of media specialists with a background of training in the same field as the instructors may be one way of shortening this period.

5. When the teaching effectiveness of media innovation was conducted, an evaluation specialist was called in to assist in this process. In situations where department faculty were trained in testing research, the services of an evaluation specialist was not used.

The other major task for the investigators in Part A of the study dealt with devising models of hypothetical procedures for media innovation in instructional systems development. The resultant models were based on information obtained through (1) an examination of successful media innovation at Michigan State University and other institutions, (2) a review of literature and research on learning and methods of instruction, and (3) a simulation of instructional development in working actual courses of study; specialists and instructors.

A variety of administrative models for media innovation were suggested, largely based on the varying situations observed at different institutions:

Administrative Organization Models

A. The Central Model: All activities take place under one roof--under a single administrator usually representing all the components of a development center and the clientele as well. The users come to the center for assistance. All specialists within the center are trained for specific tasks.

B. The Centralized Model: Each academic sub-unit or department has a miniature development center with members of the sub-unit being trained to assist fellow members in instructional situations. Each sub-unit would have its own materials library, machine distribution and maintenence, etc.

C. The Supermarket Model: Each specialist works independently of others, asking his specific questions and making his specific recommendations. In some cases, a specialist would be dependent upon what others had noted and recommended, in other cases, no continuity would be observed.

D. The Togetherness or Conference Model: All specialists would share in the analysis of instruction and offer recommendations at one or a series of meetings with the professor.

E. The Observation Model: Specialists critique the professor's actual teaching performance, offering media suggestions. His teaching could be videotaped so the professor could also watch.

5. When the teaching effectiveness of media innovation was conducted, an evaluation specialist was called in to assist in this process. In situations where department faculty were trained in testing research, the services of an evaluation specialist was not used.

The other major task for the investigators in Part A of the study dealt with devising models of hypothetical procedures for media innovation in instructional systems development. The resultant models were based on information obtained through (1) an examination of successful media innovation at Michigan State University and other institutions, (2) a review of literature and research on learning and methods of instruction, and (3) simulation of instructional development in working actual courses of study; specialists and instructors.

A variety of administrative models for media innovation were suggested, largely based on the varying situations observed at different institutions:

Administrative Organization Models

A. The Central Model: All activities take place under one roof--under a single administrator usually representing all the components of a development center and the clientele as well. The users come to the center for assistance. All specialists within the center are trained for specific tasks.

B. The Centralized Model: Each academic sub-unit or department has a miniature development center with members of the sub-unit being trained to assist fellow members in instructional situations. Each sub-unit would have its own materials library, machine distribution and maintenence, etc.

C. The Supermarket Model: Each specialist works independently of others, asking his specific questions and making his specific recommendations. In some cases, a specialist would be dependent upon what others had noted and recommended, in other cases, no continuity would be observed.

D. The Togetherness or Conference Model: All specialists would share in the analysis of instruction and offer recommendations at one or a series of meetings with the professor.

E. The Observation Model: Specialists critique the professor's actual teaching performance, offering media suggestions. His teaching could be videotaped so the professor could also watch.

F. The Go-It-Alone Model: One specialists is assigned to one instructor. Together they seek out problems and solutions without consulting other specialists, if there are any.

G. The In-Service Model: Specialists train professors to solve their own instructional problems by educating them as to advantages, operation, and maintenance of devises - useful in large school systems or small colleges.

H. The Distribution-Library Method: No consultation services are made available to faculty, only the devices, materials, and some maintenance and procurement services - approach currently found in elementary and secondary schools.

Despite the variations in the structure of the administrative models, the investigators consider the development procedures relatively unvarying. Indeed, they may be appropriate for use by either specialist teams working with faculty or the instructor working alone. Essentially, the procedures intercept the instructional problem at the door of a learning resources center, and direct the instructor in his analysis and development work through a given sequence of decision steps with the aid of an evaluation specialist, an instructional specialist, and a media specialist. A simplified sketch of the procedures minus information feedback loops is shown in Figure 20.

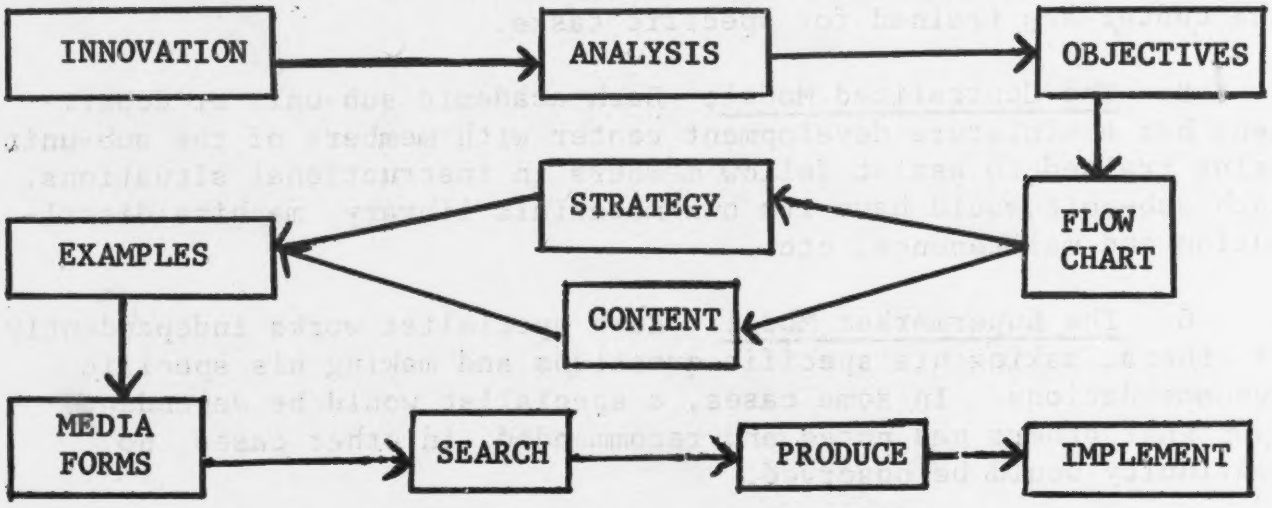


Figure 20

Procedures for Media Innovation
in
Instructional Development

The refinement of these gross development steps into specific information-seeking questions and evaluation of the resultant decisions proved to be the most complex part of the model design. The investigators were not content to accept the general statements of specialist decision functions suggested by literature and experts. They partially tested specialist and instructor competencies in the course development simulations with the following objectives in mind;

1. To more clearly delineate the "kind" and sequence of instructional problems which require a solution or decision.

2. To assess who among those persons involved is best able to make each decision.

3. To assess who among those persons involved holds the responsibility for the consequences of each decision.

4. To indicate the possibilities of communication breakdown within the activities; that is, situation where there is a lack of understanding of the others' semantics and intent.

5. To demonstrate those instructional problems for which none of the participants have the background to be able to come up with a logical alternative.

6. To point up situations which could benefit from materials or other information-giving devices in either meeting personal needs or leading to more efficient communication.

7. To indicate decision points which would best be handled through "shared" or group action.

8. To point up areas of redundancy; that is, a repetition of information needed to bring a participant up to date. In other words, to eliminate inefficient communication.

9. To assess the expectations before and after each meeting of two or more participants. Expectation is an all-inclusive term for those common vagaries; attitide, opinion, feeling, etc.

They observed that the bulk of recommendations given the instructor, and indeed his own counsel, is primarily experience or opinion-based, and somewhat conditioned by the restrictions of the physical setting. There is an obvious lack of instructional and media principles or cause and effect statements on which the specialists can rely in providing advice. Even more critical is the lack of standard analysis techniques, the bag of tools or stock and trade of the specialist.

The investigators, through analyzing tape recordings of the events in the development sessions, attempted to evolve some means to analyze the implications of data collected by the specialists. For instance, in the step calling for identification of course objectives, the investigators eventually evolved the following guidelines for the evaluation specialists to follow in working with the instructor:

1. Start where instructor is conversant; search out logic of content.
2. Compare with psychological logic of content (usually the way the instructor learned it).
3. Start with most complex goal and work back to entry knowledge and skills.
4. Work in the abstract -- speak of concepts and principles, not teaching examples of same.
5. If instructor can't explain it, have him do it himself.
6. Distinguish between mastery and discriminating objectives.
7. Have instructor weight or rank most important objectives.
8. Accentuate the content; then add the behaviors. It's much easier for the instructor.

Simulation experience with the step requiring decisions on instructional strategies also suggested a series of questions the instructional specialist could use to identify relevant teaching and learning behaviors.

1. The more complex cognitive objectives call for interaction during issues discussion; feedback on problem-solving tasks.

2. The more difficult a concept, the more likely the need for adjunct programming.

3. One-way information should be in printed form whenever possible so students can attack it at their rate, not the instructor's.

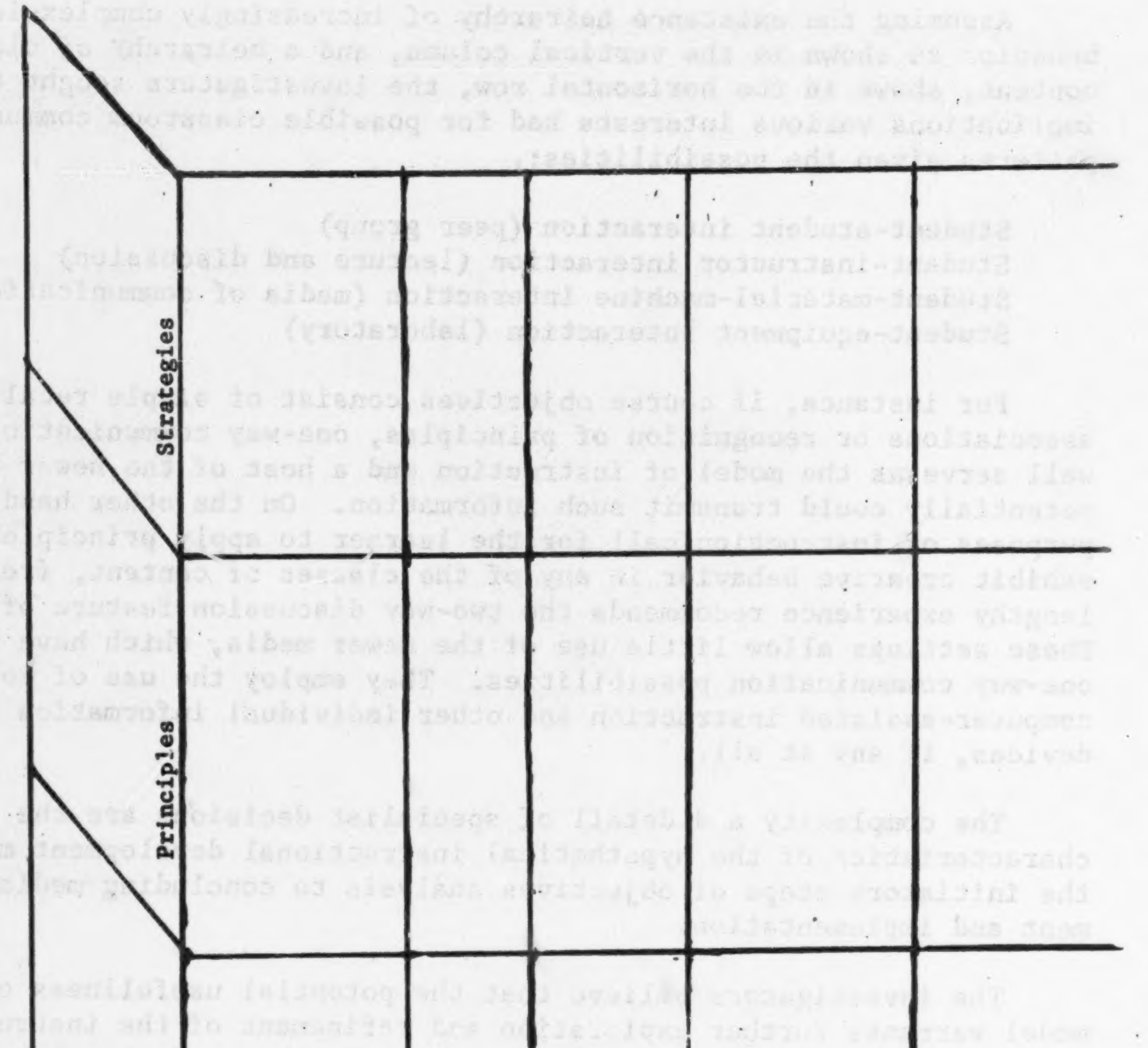
4. Instructor is needed when one-way information is undergoing rapid change rendering printed forms obsolete.

5. Student-to-student interaction should only be allowed when pre-requisite information has been learned.

An attempt was made by investigators to correlate learning behavior, content, and instructional materials by means of the matrix shown in Figure 21. This device proved moderately useful in reaching some conclusions on media usage.

Figure 21

COURSE CONTENT-LEARNING BEHAVIOR MATRIX


COURSE CONTENT
Association
Concepts
Principles
Strategies
LEARNING BEHAVIOR
Recognize
organize
Recall
list
Translate
Condense
Expand
Infer
Deduce
Induce
Analyze
Synthesize
Evaluate
Apply
Create

Assuming the existence heirarchy of increasingly complex learning behavior as shown in the vertical column, and a heirarchy of classes of content, shown in the horizontal row, the investigators sought the implications various interests had for possible classroom communication patterns given the possibilities:

Student-student interaction (peer group)
Student-instructor interaction (lecture and discussion)
Student-material-machine interaction (media of communication)
Student-equipment interaction (laboratory)

For instance, if course objectives consist of simple recall of associations or recognition of principles, one-way communication may well serve as the model of instruction and a host of the newer media potentially could transmit such information. On the other hand, if the purposes of instruction call for the learner to apply principles or exhibit creative behavior in any of the classes of content, frequent and lengthy experience recommends the two-way discussion feature of seminars. These settings allow little use of the newer media, which have mostly one-way communication possibilities. They employ the use of sophisticated computer-assisted instruction and other individual information feedback devices, if any at all.

The complexity and detail of specialist decisions are the chief characteristics of the hypothetical instructional development model, from the initiatory steps of objectives analysis to concluding media procurement and implementation.

The investigators believe that the potential usefullness of the model warrants further exploration and refinement of the instructional development steps modeled in this study. To that end they make these concluding recommendations for further study and development.

1. Test instructional development procedures in various university settings to determine the feasibility and reliability of the plan evolved in this study and refine its steps.
2. Identify heuristic principles or "workable" approaches available to the evaluation, instruction, and media specialists in their work with instructors and teaching problems.
3. Build a research-hypotheses-generating mechanism into the course development procedures to identify unknowns particular to this process and make possible more integrated and applicable research.
4. Explore the nature of substantive preparation programs of preparation for specialists in instructional design and media application to teaching.
5. Disseminate the findings of successful media innovation and instructional development to broaden the base of these efforts and deliver their benefits to more universities and colleges.

BIBLIOGRAPHY

1. Ackoff, Russell. Scientific Method: Optimizing Applied Research Decisions. New York: John Wiley and Sons, 1962.

2. Allen, William H. Audio-Visual Communication Research. Santa Monica, California: Systems Development Corporation, 1958.

3. Aronson, Arnold E. and Irwin, John V. Television Teaching. University of Wisconsin Television Lab Bulletin No. 11, 1958.

4. Audiovisual Instruction. Vol. VIII, No. 4 (April, 1963).

5. Audiovisual Instruction. Vox. X, No. 5 (May, 1965).

6. Baizey, John. The Economics of Education. Great Britain: The Free Press of Glencoe, Inc., 1962.

7. Barson, John, Gordon, John M., and Hornbaker, W. Russell. "Standard Operating Procedures for a Learning Resources Center: A System for Producing Systems," Audiovisual Instruction, Vol. X, No. 5 (May, 1965), pp.378-379.

8. Bellack, Arno A. (ed.). Theory and Research in Teaching. New York: Teachers College, Columbia University, 1963.

9. Bennett, E., Degan, J., and Spiegel, J. (eds.). Human Factors in Technology. New York: McGraw-Hill Book Company, 1963.

10. Bennis, Warren G., Benne, Kenneth D., and Chin, Robert. (eds.). The Planning of Change. New York: Holt, Rinehart and Winston, Inc., 1962.

11. Bern, Henry. "Audiovisual Engineers," Audiovisual Instruction. (1961).

12. Bloom, Benjamin S. (ed.). Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook 1: Cognitive Domain. New York: Longmans, Green and Co., 1956.

13. Bolvin, Boyd M., Finn, James D., and Perrin, Donald G. A Selective Bibliography on New Media and Instructional Technology. Los Angeles: University of Southern California.

14. Boutwell, William D. Using Mass Media in the Schools. New York: Appleton-Century-Crofts, 1962.

15. Broudy, Harry S. "The Education of Teachers of Teachers," The Journal of Teacher Education, Vol. XIII (September, 1962), pp. 284-291.

16. Broudy, Harry S., Smith, B. Othanel, and Burnett, Joe R. Democracy and Excellence in American Secondary Education: A Study in Curriculum Theory. Rand McNally & Company, 1964.

17. Brown, James W. and Thornton, James W. Jr. (eds.). New Media in Higher Education. Washington, D. C.: National Education Association, 1963

18. Bruner, J. S. The Process of Education. Cambridge: Harvard University Press, 1956.

19. Bushnell, Donald D. "The Role of the Computer in Future Systems," Audiovisual Communication Review, Vol. XI (March-April, 1963).

20. Cameron, Frank and Finch, Glen. Air Force Human Engineering, Personnal, and Training Research. Publication #516. Washington, D. C.: National Academy of Sciences, National Research Council, 1958.

21. ______. Air Force Human Engineering, Personnel, and Training Research. Publication #445. Washington, D. C.: National Adacemy of Sciences, National Research Council, 1956.

22. Carpenter, C. R. "Approaches to Promising Areas of Research in the Field of Instructional Television," New Teaching Aids for the American Classroom. Stanford, 1960. pp.73-95.

23. Chase, Francis S. "Some Effects of Current Curriculum Projects on Educational Policy and Practice," The School Review, Vol. LXX (Spring, 1962), pp. 132-147.

24. Clark, David L. and Cyphert, Frederick R. Teacher Behavior as a Conceptual Base for the Professional Education of Teachers. Ohio State University, 1963. Mimeographed.

25. Cogswell, John and Egbert, Robert L. New Solutions to Implementing Instructional Media Through Analysis and Simulation of School Organization. USOE Report. Santa Monica, California: Systems Development Corporation, 1964.

26. The Commission on Teacher Education. Teacher Competence: Its Nature and Scope. Burlingame, California: California Teachers Association, 1957.

27. Comparative Research on Methods and Media for Presenting Programmed Courses in Mathematics and English. University Park, Pennsylvania: Pennsylvania State University, 1963.

28. Davidson, Maria and Scott, Ellis. Simulation Techniques and Their Application. Santa Monica, California: Systems Development Corporation, 1963.

29. de Grazia, Alfred and Sohn, David A. (eds.). Revolution in Teaching: New Theory, Technology, and Curricula. New York: Bantam Books, 1964.

30. Denemark, George W. (ed.). Criteria for Curriculum Decisions in Teacher Education: A Report from the ASCD Commission on Teacher Education. Washington, D. C.: Association for Supervision and Curriculum Development, 1963.

31. Dunbar, Willis F. The Michigan Record in Higher Education. Detroit, Michigan: Wayne State University, 1963.

32. Eckman, D. P. (ed.). Systems: Research and Design. John Wiley and Sons Incorporated, 1961.

33. Eddy, Edward D. Jr. The College Influence on Student Character. Washington, D. C.: American Council on Education, 1959.

34. Edling, Jack V. (ed.). The New Media in Education. Sacramento, California: Western Regional Conference on Educational Media Research, 1960.

35. Educational Facilities Lab. New Building on Campus. Six Designs for a College Communications Center.

36. Education and the Structure of Knowledge: Fifth Annual Phi Delta Kappa Symposium on Educational Research. Chicago: Rand McNally & Co., 1964.

37. Egbert, Robert L. and Cogswell, John. Systems Design for a Continuous Progress School: Part II Surveillance and Detection System. Santa Monica, California: Systems Development Corporation, 1964.

38. Egbert, Robert L. Simulation: A Vehicle for Facilitating Innovation and System Design in Education. Santa Monica, California: Systems Development Corporation, 1962.

39. Ellena, William J., Stevenson, Margaret, and Webb, Harold V. (eds.). Who's a Good Teacher? Washington, D. C.: American Association of School Administrators, 1961.

40. Ellis, D. and Ludwig, J. Systems Philosophy. Englewook Cliffs, New Jersey: Prentice-Hall Incorporated, 1962.

41. Ely, D. P. "The Changing Role of the Audiovisual Process in Education," Audiovisual Communication Review, (January-February, 1963).

42. Eurich, A. C. "A 21st Century Look at Higher Education," Liberal Education, Vol. LIX (March, 1963), pp.22-23

43. Evans and Arnstein (eds.). Automation and the Challenge to Education. Washington, D. C.: National Education Association, 1962.

44. Experimental Study in Instructional Procedures. Oxford, Ohio: Miami University, 1960.

45. Finn, J. D. "Technology and the Instructional Process," Audiovisual Communication Review, (Winter, 1960).

46. Foshay, Finette P. Interaction in Learning: Implications for Television. Washington, D. C.: National Education Association, 1959.

47. Frazier, Alexander and Wigren, Harold E. (eds.). Opportunities for Learning: Guidelines for Television. Washington, D. C.: National Education Association, 1959.

48. Froehlich, Herbert P. "What About Classroom Communicators?" Audiovisual Communication Review, (May-June, 1963).

49. Fundamentals of Teaching Machine and Programmed Learning Systems. Los Angeles: Education and Training Consultants, 1964.

50. Gage, N. L. (ed.). Handbook of Research on Teaching. Chicago: Rand McNally & Company, 1963.

51. Gagne, Robert M. (ed.). Psychological Principles in System Development. New York: Holt, Rinehart and Winston, 1962.

52. ________. (ed.). "The Analysis of Instructional Objectives," I. Teaching Machines and Programmed Learning, II. Data and Directions, ed. Robert Glaser. Washington, D. C.: NEA Department of Audiovisual Instruction, 1964.

53. Galanter, Eugene (ed.). Automatic Teaching: The State of the Art. New York: John Wiley and Sons, Inc., 1959.

54. Geisler, M. A. Development of Man-Machine Simulation Techniques. Rand Corporation, 1960.

55. Gilpin, John. "Design and Evaluation of Instructional Systems," Audiovisual Communication Review, Vol. X, No. 2 (January-February, 1962), pp. 75-84.

56. Glaser, Robert (ed.). Training Research and Education. Pittsburgh: University of Pittsburgh Press, 1962.

57. Goldsmith, A. N. "Communications and Electronics--2012 A. D.," Proceedings of the Institute of Radio Engineers, (1962), pp. 562-656.

58. Greenhill, L. P. The Evaluation of Instructional Television. University Park, Pennsylvania: Pennsylvania State University, 1963.

59. Griffiths, Daniel E. (ed.). Behavior Science and Educational Administration. Chicago: National Society for the Study of Education, 1964.

60. Grimes and de Kieffer (eds.). Status: The Status of Audiovisual Activities of NUEA Member Institutions. Division of Audiovisual Communications of the National University Extension Association.

61. _______. (eds.). Symposium on Simulation Models: Methodology and Applications to the Behavioral Sciences. Cincinatti: South-Western Publishing Co., 1963.

62. Hall, Authur D. A Methodology for Systems Engineering. New Jersey: D. Van Nostrand Company, Inc., 1962.

63. Harcleroad, Fred, et al. Learning Resources for Colleges and Universities. Hayward, California: California State College, 1964.

64. Hickey, Albert E. and Newton, John M. The Logical Basis of Teaching: The Effect of Subconcept Sequence on Learning. Office of Naval Research, 1964.

65. Highet, Gilbert. The Art of Teaching. New York: Alfred A. Knopf, 1950.

66. Hilgard, Ernest R. "The Human Dimension in Teaching," AHE College and University Bulletin, Vol. XVIII, No. 11 (March 15, 1965), pp. 1-3.

67. Hilton, Alice Mary. Logic, Computing Machines, and Automation. Washington, D. C.: Spartan Books, 1963.

68. Hoggatt, Austin Curwood and Balderston, Frederick E. (eds.). Symposium on Simulation Models: Methodology and Applications To the Behavioral Sciences. Cincinnati: South-Western Publishing Co., 1963.

69. Holmes, Presley D. Jr. Television Research in the Teaching-Learning. Detroit, Michigan: Wayne State University, 1959. A dissertation.

70. Institute for Communication Research, Stanford University. Annual Report of Research in Progress, 1963.

71. The Institute for Communication Research. New Teaching Aids for the American Classroom. Stanford, 1960.

72. An Investigation of Closed-Circuit Television for Teaching University Courses. Report Number Two: The Academic Years 1955-56 and 1956-57. University Park, Pennsylvania: Pennsylvania State University.

73. Kenner, Joseph H. A Report on Television in Basic Training: The Improvement of Basic Training by Television. Office of the Chief Signal Officer, 1963.

74. Krathwohl, David R. "Comments on Robert M. Gagne's Paper, 'The Analysis of Instructional Objectives,'" National Education Association, 1963.

75. Kuwata, Hideya. An Inventory of Instructional Television Research. Ann Arbor, Michigan: Educational Television and Radio Center, 1956.

76. Landmark, Nora, et al. Report of the Planning Committee of University College. East Lansing: Michigan State University, 1963.

77. Learning Resources for Higher Education. East Lansing: Michigan State University, 1962. Unpublished report.

78. Leverenz, Humboldt W. and Townsley, Malcolm G. The Design of Instructional Equipment: Two Views. Washington, D. C.: National Education Association.

79. Maccia, Elizabeth Steiner. An Educational Theory Model: Graph Theory. Ohio: Bureau of Educational Research and Service, 1962.

80. ________. An Educational Theory Model: Information Theory. Ohio: Bureau of Educational Research and Services, 1963.

81. Maccia, George S. An Educational Theory Model: General Systems Theory. Ohio: Bureau of Educational Research and Service, 1962.

82. Mager, Robert F. Preparing Objectives for Programmed Instruction. San Francisco: Fearon Publishers, Inc., 1962.

83. Marquis, Stewart D. Bibliography on Systems. East Lansing: Michigan State University, 1963.

84. Mauch, J. "A Systems Analysis Approach to Education," Phi Delta Kappan, (January, 1962).

85. McMillan, Claude and Gonzalez, Richard F. Systems Analysis: A Computer Approach to Decision Models. Homewood, Illinois: Richard D. Irwin, Inc., 1965.

86. Meaney, John W. Televised College Courses. Fund for the Advancement of Education, 1962.

87. Melton, Arthur W. Categories of Human Learning. New York: Academic Press, 1964.

88. Miles, Matthew B. (ed.). Innovation in Education. New York: Teachers College, Columbia University, 1964.

89. Miller, Neal E. Graphic Communication and the Crisis in Education. Washington, D. C.: National Education Association, 1957.

90. Miller, Robert W. Schedule, Cost, and Profit Control with Pert. New York: McGraw-Hill, Inc., 1963.

91. Molstad, John A. Sources of Information on Educational Media. Washington, D. C.: U. S. Government Printing Office, 1963.

92. Morris, Barry (ed.). "The Function of Media in the Public Schools," Audiovisual Instruction, (January, 1963), pp. 9-14.

93. Newell, Allen. Computer Simulation of Human Thinking. Rand Corporation, 1961.

94. 1962-1963 Report of Progress. East Lansing: Michigan State University. Unpublished report.

95. Operational Plans for Developing Regional Educational Media Research Centers. University Park, Pennsylvania: Pennsylvania State University, 1962.

96. Oregon State System of Higher Education. *Inter-Institutional Teaching by Television*. Report: *No. 1, 1957-1959.*

97. Palmer, John R. and Broudy, Harry S. *Exemplars of Teaching Method*. Chicago: Rand McNally & Co., 1965.

98. Pollack, T. C. "New Patterns and New Media for Education," *North Central Association Quarterly*, Vol. XXXV (April, 1961), pp. 299-301.

99. Postlethwait, S. N. "A Systems Approach to Botany," *Audiovisual Instruction*, (April, 1963).

100. Postlethwait, S. N., Novak, J., and Murray, H. *An Integrated Experience Approach to Learning*. Burgess Publishing Company, 1964.

101. Rice, Charles E. "A Model for the Empirical Study of a Large Social Organization," *General Systems*. New York: Society for General Systems Research, 1961. pp. 101-106.

102. Roe, Arnold. *An Adaptive Decision Structure for Educational Systems*. Los Angeles: University of California.

103. Rogers, Everett M. *Diffusion of Innovations*. New York: MacMillan Company, 1962.

104. Rome, B. K. and Rome, S. C. *Automated Learning Process*. Santa Monica, California: Systems Development Corporation, 1962.

105. Ryans, David G. *An Information-System Approach to Instruction with Special Reference to the Teacher*. Santa Monica, California: Systems Development Corporation, 1963.

106. ______. "Assessment of Teacher Behavior and Instruction," *Review of Educational Research*, Vol. XXXIII (October, 1963), pp. 415-441.

107. ______. *Characteristics of Teachers, Their Description, Comparison and Appraisal: A Research Study*. Washington, D. C.: American Council on Education, 1960.

108. ______. *Evaluation and the Improvement of Instruction*. Chicago, 1964. Paper presented at AERA, Chicago.

109. ______. *System Analysis in Educational Planning*. Santa Monica, California: Systems Development Corporation, 1964.

110. *Schools for the Sixties: A Report of the Project on Instruction*. New York: McGraw-Hill Book Company, Inc., 1963.

111. Schramm, Wilber (ed.). *New Teaching Aids for the American Classroom*. Stanford University: Institute for Communication Research.

112. Schramm, Wilber. *Research on Programmed Instruction*. Washington, D. C.: U. S. Department of Health, Education, and Welfare, 1964.

113. Silberman, Harry F. "A Symposium on Current Research on Classroom Behavior of Teachers and Its Implications for Teacher Education," *The Journal of Teacher Education*, Vol. XVI (September, 1963).

114. Silvern, G. M. *Non-Programmed Curriculum Materials for Computer Programmer Training Programs*. North American Aviation, Incorporated, 1962.

115. Silvern, Leonard C. *Textbook in Methods of Instruction*. Culver City, California: Hughes Aircraft Company, 1957.

116. Singer, L. "Florida Atlantic University: Where Tomorrow Begins," *Audiovisual Instruction*, Vol. VIII (April, 1963), pp. 236-242.

117. Smith, B. Othanel and Meux, Milton. *A Study of the Logic of Teaching*. Urbana: University of Illinois.

118. Smith, B. Othanel. "Toward a Theory of Teaching," *Theory and Research in Teaching*, ed. Arno A. Bellack. New York: Teachers College, Columbia University, 1963.

119. Sullivan, George. *The Image of the Effective Teacher*. New York: Teachers College, Columbia University, 1962.

120. Taba, Hilda. "Teaching Strategy and Learning," Reprinted from *The California Journal for Instructional Improvement*, (December, 1963).

121. Travers, Robert M. W. *Essentials of Learning*. New York: McMillan Co., 1963.

122. Trow, William Clark. *Teacher and Technology: New Designs for Learning*. New York: Appleton-Century-Crofts, 1963.

123. Trump, Lloyd J. Images of the Future: A New Approach to the Secondary School. Washington, D. C.: National Education Association, 1959.

124. Uhlaner, Julius E. Systems Research--Opportunity and Challenge for the Measurement Research Psychologist. Military Personnel Research, 1960.

125. United States Office of Education. The Experimental College. OE-50010, No. 3. Washington, D. C.

126. ________. Faculty and Other Professional Staff in Institutions of Higher Education: First Term 1959-1960. OE-53000-60.

127. ________. Flexibility in the Undergraduate Curriculum. OE-500032, No. 10.

128. ________. Higher Education - Basic Student Charges. 1962-1963. OE-52005-63.

129. ________. Improving the Learning Environment. OE-34031, 1963.

130. ________. Internal Structure: Organization and Administration of Institutions of Higher Education. OE-53012.

131. ________. Language Laboratory Facilities. OE-21024, No. 4.

132. ________. Library Statistics of Colleges and Universities: 1962-63. OE-15023-63.

133. ________. Motion Picture Production Facilities of Selected Colleges and Universities. Washington, D. C., 1963.

134. ________. New Construction and Rehabilitation on College Campuses: 1959-60 and 1960-61. OE-51002-61.

135. ________. Technology in American Education: 1650-1900. OE-34018, No. 1.

136. ________. Technology in the Classroom: Challenges to the School Administrator. OE-34005.

137. ________. Trends in Engineering Education: 1949-1959. OE-56003.

138. Wiener, Norbert. The Human Use of Human Beings. Garden City, New York: Doubleday and Company, Inc., 1954.

139. Wittich, Walter A. and Schuller, Charles F. Audiovisual Materials: Their Nature and Use. 3rd edition. New York: Harper & Brothers, 1962.

140. Woodruff, Asahel D. Basic Concepts of Teaching. San Francisco: Chandler Publishing Company, 1961.

141. ________. "The Use of Concepts in Teaching and Learning," The Journal of Teacher Education.

B-383

FINAL REPORT

Grant No. OE-3-16-030

A PROCEDURAL AND COST ANALYSIS STUDY OF MEDIA IN INSTRUCTIONAL SYSTEMS DEVELOPMENT

- PART B -

September 1, 1965

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Office of Education
Bureau of Research

AA000078

INSTRUCTIONAL COST ANALYSIS

With Particular Reference to the Use of Media in Instruction

Instructional Systems Development Project
Office of Institutional Research,
Audiovisual Center, and
College of Business

Michigan State University

and

The United States Office of Education

1965

Gardner M. Jones, Ph.D., C.P.A.
Cost Analysis Project Director

The study reported herein was performed pursuant to a contract (#OE-3-16-030) with the United States Office of Education, Department of Health, Education and Welfare.

PROJECT STAFF

Advisory Committee

Dr. Paul Dressel, Chairman, Director, Office of Institutional Research

Dr. Charles F. Schuller, Director, Audiovisual Center

Dr. J. Don Edwards, Chairman, Department of Accounting and Financial Administration

PART A - PROCEDURAL ANALYSIS

Director: Dr. John Barson
Associate Professor of Education

Associate Director: Dr. Horace C. Hartsell, Professor of Education

PART B - COST ANALYSIS

Director: Dr. Gardner M. Jones
Professor of Accounting

Research on Annotated Bibliography: Dr. T. Harry McKinney

Staff Specialists

Dr. John M. Gordon, Jr.
W. Russel Hornbaker

Secretary: Kathi Ensworth

Carol Cunningham
Wayne Cunningham, C.P.A.
Albert Ewald
Tom Notarainni
George Tatu

Secretary: Jeanne Bournazos

I

INTRODUCTION

Enrollments and salary costs both rising more rapidly than revenues have prompted colleges and universities, in recent years, to try to find new ways to get the educational job done within the limits of available resources. Inevitably, if an institution is to improve the productivity of its expenditures, it must be able to identify the points at which improvements are possible. To do so, it must find out what it is getting for dollars spent in each of its many segments and activities and programs.

There has been plenty of agreement on the need for developing more efficient educational processes. There has been a dearth of information on how to go about it. Those who have tackled the job of identifying university products and the costs which go with the products have found the task thoroughly discouraging. Universities are complex organisms, and it is nearly impossible to sort out the efforts which yield bachelors' degrees from those which yield experimental research results. Measurement of the values attaching to the products themselves is even more difficult.

The Instructional Systems Development Project, undertaken at Michigan State University under the sponsorship of the U. S. Office of Education, is an attempt to solve the problem of more effective instruction with limited resources. The project encompasses a number of experimentations with the use of media in instruction. Parallel with these experiments in media usage, an attempt has been made to identify instructional costs connected therewith. The results are presented in the project

Final Report, in which data and discussion about instruction, media development, and cost identification are intermingled.

The present volume deals only with cost aspects of higher education, particularly with our attempts to identify the costs of performing particular functions, such as the reconstruction and operation of courses according to the course-building model developed in the project. We also present some observations regarding the means and pre-conditions for future measurement of instructional costs to an extent that is not possible under current university accounting classifications.

The ISD project was carried on by a two-part study group. The Instruction System Development group consisted of persons from the College of Education and from the Audio-Visual Center; the Cost Analysis group consisted of persons from the College of Business. Both groups worked under the general direction of an Advisory Committee consisting of administrators in MSU's Office of Institutional Research, Audio-Visual Center, and College of Business. Staff specialists, who did the bulk of the investigative work, were doctoral candidates in Education and in Business Administration. All personnel were on a part-time basis, except for short periods.

The two study groups produced jointly a report entitled "A Procedural and Cost Analysis Study of Media in Instructional Systems Development." That report is being submitted separately to the project sponsor.

II

PURPOSES AND USES OF COST ANALYSIS IN INSTRUCTION

At least three reasons can be seen readily for an interest in the costs of instruction.

1) The pressures of increasing enrollments, with less than comparable increases in faculty and facilities, make it necessary for university administrators to find ways to extend existing capabilities. The range of responses to huge enrollments is wide:

a) a simple enlargement of classes to the limits of physical capacity
b) employment of mass communication devices (TV, films, taped lectures) and use of self-teaching materials
c) revision and restructuring of course content to reduce the number of offerings
d) extension of the school day to early morning, late afternoon, and night classes; and around-the-clock laboratory usage
e) frantic building programs and vigorous faculty recruitment
f) limitation of enrollments to predetermined levels, either by arbitrary quotas or by raising entrance requirements

Each approach is a partial answer, and each has its unique disadvantages either in terms of practicability or of educational quality. For example, some schools do not have access to the means to support extensive building programs or intensive faculty recruitment. Others are precluded by state-wide fixed salary structures from engaging competitively in the search for qualified faculty. Most publicly-supported institutions are forbidden, either by constitution or by community expectation, from raising entrance requirements, or from cutting off enrollments.

Some of the solutions are thought, by many teachers, parents, and administrators, to be damaging to the quality of educational experience for the student. Particularly criticized are: the impersonal crowding of students into large classes where conversation and intellectual interplay are no longer possible; and, the burden of numbers to the point where faculty members cannot examine and comment critically upon the quality of work done by the student. Some think the very impersonality of mass communications, machine scoring and the impossibility of professorial contact except by appointment destroy the important intellectual and emotional stimulation of personal dialogue with the teacher. Not everyone agrees, of course. It is said that, in large universities, the stimulation of personal contact has been only a dream, a figment of imagination anyway; we lost personal contact with the influx of GI students after World War II and we have never regained it.

Fortunately, it is not the job of cost analysts to judge the qualitative merits of mass education, but their duty is to assist in measuring its economic aspects. The analysis of the costs connected with various modes of reaching large numbers of students should be useful in choosing the ways to face the pressures of mounting enrollments.

2) Scarce resources must be assigned according to some scheme of priorities. Since all university resources--time, materials, physical plant--are economic resources, presumably the economic values of university "products" should be considered in deciding upon the composition of the "product mix." To the extent possible, scarce resources should be devoted to those outputs which will maximize total value to society, where that total value consists of economic values as well as social values. The complexities of establishing finite measures for such values are illustrated at the end of this chapter in the description of "Public Olympic University," a case prepared for class discussion at MSU.

If any valid, or even plausible, relationship can be established between resource usage (i.e., costs, economic inputs) and the "products" of a university, then cost analysis can play a part in evaluating alternatives for the assignment of scarce resources. Furthermore, where any common measures of productivity are possible (for example, student credit hours taught per full-time faculty member), these common measures provide good clues for the profitable assignment of additional resources. Just as in business where a high rate of return for a particular product justifies investing additional funds there, in university administration a high yield (number of hours taught, counsellees served well, etc) per unit of input may justify investing added resources in the department where the high yield occurs.

3) Control of educational costs is necessary. The taxpayers who support public higher education expect prudent management in institutions of higher education. Although there are differences, necessarily, in the amounts of money needed to support various fields of training, comparisons should be made between fields and departments, and between institutions as well. Where relatively little is produced relative to resources used, or where amounts spent are disproportionate to outputs (degrees, research, or impact upon public consciousness) some sound non-economic justification must be demonstrated. Control of costs, it should be pointed out, is done not by reporting after-the-fact, but by advance planning for cost incurrence related to expected tasks. Thus, sound knowledge of cost and load relationships is basic to effective cost control. Cost planning by functional categories (i.e., by the job to be done) and budgeting by jurisdictional categories are not the same thing, but are related. Cost reporting (after-the-fact) is also essential, for comparison with planned costs, so that a better planning job can be done for subsequent periods and tasks. Costs are incurred by jurisdictions

(i.e., by persons in charge of colleges, departments, or other units). It follows that cost control must be exercised by jurisdictions, i.e., by means of unit budgets.

However, jurisdictional budgets do not provide functional cost data. For measuring costs and results, it is necessary to perform functional costing right down to the level of specific products, i.e., courses or research projects, or programs. Understandably, a considerable amount of cost allocation is involved here. Allocation procedures will move appropriate pieces of cost from their points of initial incurrence to the function (i.e., courses) which ultimately benefit therefrom. The accumulative costs for any one course are subject to error because of the necessary arbitrariness of the allocation procedures.

On the results side, we cannot state our conclusions in precise dollars-and-cents terms. Values of the outputs of any given course may be quite intangible. Thus it can be said that no matching of arbitrary, unprecise costs and intangible, subjective results is possible. However, we think that even crude cost figures for a given course will give a useful tool to administrators who must spread the funds as far as possible and to best educational effect.

Having some notion of the unit costs of producing a course, the administrator then can ask questions of its value in relation to other courses. For example, if a department offers an undergraduate course three times a year, drawing only 12 students each time, with a unit cost of $225 per student, the administrator cannot say it is unjustified; he can say, however, that the department concerned must find a convincing argument for continuing its frequent offering, or possibly for its retention at all. The argument will have to be in terms of its educational value, or its key position in the scheme of things.

Caution is properly urged in weighing educational efforts on an economic scale. However, an understanding of the price paid to get something desirable (i.e., a course) may bring about much more thorough consideration of the real necessity of getting that thing. And hopefully, if it is educationally essential, knowledge of the economic cost will lead to finding ways to get the same job done more efficiently, by those who assert its essentiality.

4) Probably, the least important reason for costing is to set product prices. In almost all circumstances, in industry or education, prices are determined by outside factors, rather than by the particular producers' costs, and therefore are a minor costing purpose. However, price differentials for product variations may be cost-based or cost-related. Thus, for example, premium tuition rates for medical school could be justified on the basis of cost differentials, as compared with most liberal arts curricula.

Appendix to Chapter II

Public Olympic University
(A Product Mix Problem)

A case prepared for class discussion at Michigan State University

(Note: this case is intended for class discussion only and does not represent any particular institution. Costs and values given herein are illustrative, not actual).

The output of a college or university consists of a variety of things which are neither totally dependent or independent. For example, research activity may have an effect upon student output; to the extent that faculty resources are used for research they are not available for teaching. At the same time, funds obtained for research assistance provide subsidy to students, enabling completion of degrees for many graduate students. Part of university effort is expended in image creation, which in turn has some bearing on resources available for research and/or degree production. Total outputs for a university consist of degrees, research, and publicity.

It is very difficult to value outputs of such a complex organism, or even to separate research effort from teaching effort from image creation effort; they are intertwined. Outputs can perhaps be measured best in "utiles", i.e., in some kind of unit which measures social value created. However, the resources used all have economic prices. To make product-mix choices, we must attach economic prices to outputs. This is necessary for judging which product-mix will make optimum use of the university's scarce resources.

For the sake of this problem, we arbitrarily establish the following product-price assumptions:

Degrees. a) The production of a Bachelor's degree is, at the moment of completion, worth the present value of the lifetime stream of incomes it provides for its holder. We refer here to the income differential obtained as compared with a high school diploma. (We recognize that social attitudes, culture, citizen consciousness, etc., engendered by education, have values too; but for purposes of this problem, we assume that economic payoff will be the criterion for valuation of a degree as a university product).

b) The production of a Master's degree is, at the moment of its completion, worth the present value of the lifetime stream of income differential it provides.

c) The production of a Doctoral degree is, at the moment of its completion, worth the present value of the lifetime stream of income differential it provides.

Degree costs, for our problem, include only university costs, not those of the individual; it is the university's resources we wish to allocate to product-mix elements.

Research

We arbitrarily assume that faculty members, on the average, spend a constant fraction of their time in research. There are some who are 100% research, a few who are 100% teaching, but the typical faculty member is continually devoting a part of his time to experimenting (just as this faculty member, in constructing this problem, is experimenting with construction of a descriptive model, which if successful could become a predictive model).

Image Creation

At least six distinct image-creation activities are identified. In particular institutions, many other approaches to influencing students, parents, foundations, legislative bodies, the community, high schools, employers, are taken. We think they can all be included in the following grouping:

Activities which use faculty time specifically:

1. Faculty publications (Typically, this is connected with research effort also).
2. Conferences and meetings identified with university.
3. Off-campus lectures and non-degree, non-credit courses.

Activities which usually do not use faculty time:

4. Public-relations literature, brochures, announcements, etc.
5. Relations with high schools and other institutions
6. Athletic programs

It is assumed that the primary impact, economically, of all these public relations activities is upon public consciousness of the institution, and therefore upon the willingness of the public, as taxpayers, to provide appropriated funds for operation of the university. The productivity of any one image creation agent, such as a high-school relations bureau, is not measurable in specific terms, especially since cause and effect are likely to be not only remote in time, but cumulative in effect. For the purposes of this problem, economic results of public relations actions are assumed, with current payoffs (appropriations) being based on cumulative effects of prior years' resource uses in image creation. Current image creation resource uses, in turn, are expected to result in subsequent years' payoffs.

Total output values

Total output values, then, consist of the above 3 mentioned items:

output	values
a) academic degrees (all levels)	future income of graduates
b) publicity and opinion-shaping	legislative appropriations
c) research	improvement in society

Measures of payoffs

a) Academic degrees. Bachelor's degree differential, $3000 per year for 30 years. Master's degree differential (over bachelor's), $1000 per year, for 25 years. Doctoral degree differential (over master's), $2000 per year, for 20 years. No value is attached to partially completed degrees. (Question: what about 2-year programs?)

b) Image creation. It is assumed that all payoffs come 20% this year, 50% next year, and 30% the following year. The following arbitrary payoff assumptions are made:

1. Faculty publications, $50 for each item published this year, but with no more than 3 publications per faculty member per year.

2. Conferences and meetings, on-campus, $4 per registrant, up to 100,000 registrants per year. Lectures off-campus, $5 per lecture, up to 2 lectures per faculty member per year.

3. Off-campus courses, $2 per enrollee, up to a maximum of 10,000 enrollees per year.

4. Public relations literature, brochures, etc. Not determined; to be discussed.

5. High-school relations. Not determined; to be discussed.

6. Athletic programs. Payoffs vary with type of contest. Public image as to athletics is based heavily on football and basketball wins and losses. For purposes of the problem, we divide athletic contests into

3 categories:

Class A, payoffs are \$50,000 per game, but up to only 7 games per year.

Class B, payoffs are \$5,000 per game, but up to only 20 games per year.

Class C, payoffs are \$5 per game, but up to only 300 games per year.

(Problem: Where athletic programs are self-supporting, are they cost-free?)

c) Research

It is assumed that research payoffs for society are directly proportional to faculty time put into research. For every hour of faculty time and \$1 of materials put into research, future payoffs amount to \$3 per year, over a 20-year period. Output value is the discounted present value of these future payoffs. (Question: Are there different payoffs for different types of research?)

Input costs

For the purposes of this problem, professorial time is valued at \$10 per hour, as an average for all ranks. This figure includes fringe labor costs. For each hour of faculty time, \$5 of supporting services (secretarial, supplies, etc.) are required. Faculty time available per full-time faculty equivalent is 1500 hours per academic year. The university has 1000 full-time equivalent faculty members.

Assume that faculty time can be assigned to any of the three classes of output, but within limitations. Specifically, not more than $^1/_3$ of faculty time can be devoted to research, and not more than $^1/_5$ to the image-creating class of activities in total. Items 4, 5, and 6 under image creation do not usually require faculty time directly but require substitutions of other persons and services with rates and costs equivalent to faculty rates and costs. There are 100 such persons in the organization; therefore the university has, in total, the equivalent of 1100 full-time faculty members. Assume that within the image-creation activities, resources can be shifted among the types of outputs.

Assume also, that there are restricting relationships among the student outputs:

For every 100 undergraduate degrees awarded, there can be a minimum of 10 and a maximum of 40 master's degrees, and a minimum of zero and a maximum of 10 doctoral degrees.

Assume that the production of an undergraduate degree requires an annual input of $^1/_8$ of a full-time faculty member over a 4-year period; a masters degree, $^1/_6$ of a full-time faculty member over a 2-year period, and a doctor's degree $^1/_4$ of a full-time faculty member over a 3-year period.

Assume that space is not a limitation, and that other university activities (payroll, resident hall management, maintenance, etc.) are not affected by product mix.

Required: With this as a starting point, determine the factors that would be necessary for constructing an input-output model for Public Olympic University, and suggest ways to go about obtaining and quantifying the necessary data to be used in the model.

III

PRECEDENTS FOR INSTRUCTIONAL COST ANALYSIS

In this chapter, we consider the institutional and accounting methodology backgrounds for cost analysis within universities, and observe some of the characteristics of cost behavior which are applicable to high education.

Budgetary vs. functional accounting

The historical development of college accounting has been entirely along lines of administrative jurisdiction. Emphasis has always been on making sure that the institution, and each of its internal segments, spent no more than the amount provided by its revenues and/or legislative appropriation. To this end, budget allowances for each department are pre-established at the beginning of each year, and accounting transactions are recorded as charges against these budget allowances. To be doubly sure that budget ceilings are not violated, a procedure called encumbrance accounting often is employed to charge commitments against budget allowances as soon as a purchase order is issued or a contract signed.

Within departmental or unit budget allowances, expected costs are further identified by object of expenditures: salaries, travel, supplies and service, student labor, etc. Transaction documents then provide for each such expenditure category within each department's accounts. For example, an account number such as 01-0432-07 might mean:

01	fund source
04	college
32	department
07	object of expenditure

Annual budget allowances for departments or jurisdictional units, and for expenditure categories within those units, typically are based upon the prior year's allowance, adjusted for authorized changes in staffing, salary level changes, needs caused by enrollment increases,etc.

When the single output of a department is considered to be academic degrees, no product cost identification problem arises. But if recognition is given to the multi-product, multi-functional nature of departmental operations, the immediate difficulty of trying to establish costs for each output becomes apparent. At a time when colleges' efforts were a all directed toward a single product, i.e., academic degrees, all operating costs became embodied in that one product. Realistically, the present outputs of universities can be recognized as multiple: academic degrees, research, and image creation. Academic degrees are at various scholarly levels: certificates, bachelor, master, and doctoral. They also come out of a variety of disciplines, with substantially varying degrees of resource use required in their production. Research takes many forms; it arises from individual effort, programmed and unprogrammed, and from concerted group efforts. Its results are sometimes tangible and just as often are too intangible to measure.

These three categories of output, or product, come from a common set of resources: a faculty, a library, and physical facilities (laboratories, buildings, an organizational structure). They are true joint products. The functions of producing them are not separable. This, simply, is why we do not have functional accounting in universities and why the prospects of having clear-cut functional and/or product accounting are dim.

Lest it appear that we think that no product accounting can be done, we hasten to add that there are segments of university operation to which the traditional methods of industrial accounting may be applied. That is, certain physical operations in the maintenance area, and mass instructional operations can be measured and their resource usages quantified. The resulting average costs may be compared with some yardstick for evaluating performance, and may also be used in predicting future resource usage needs. The remainder of this chapter is devoted to ideas and techniques which may be useful in instructional cost analysis.

Product costing in industry, and applicable costing principles

The history of cost accounting for the multiple purposes of cost control, allocation of scarce resources, product pricing, and inventory valuation is an old history, extending back to the late years of the 19th century. Cost accounting was first applied to the manufacturing process, as were industrial engineering concepts. Where industrial engineering studies were aimed at the most efficient way to get specific production jobs done, cost accounting practices were aimed at the most economical way to get the product made; the differences, then, were minor; the end-purpose was the most effective use of limited resources in creating a tangible product.

Repeated observations, in physical and dollar terms, led to establishing standards as a means of measurement of effort vs. productivity. Standards represent what costs or resource (materials and time) usages should be, under standard operating conditions in repetitive and measurable production situations.

Later, it was recognized that there are some activities other than manufacturing which were repetitive and measurable, and therefore subject to the use of standards for pre-establishing what costs should be for any given job or volume of activity. These activities included mass clerical operations, and some warehousing and order-filling activities. It was also recognized that there are some activities, particularly in the sales area and in creative design situations, where the relationships between efforts and results became obscure, and where both standardization and repetitiveness were limited. Thus, standards were not applicable to cost control in these situations.

Standards were found to be useful also for product pricing. Instead of waiting until experience showed what costs _had been_, it was possible, through standards, to cost out prospective jobs or orders in advance, once the tasks required for performing the job had been identified.

Standards also were useful for cost prediction in the face of changing activity levels. By being able to plan manpower and material requirements, based on standards for expected production, it was possible to plan staffing, buying, and providing support services.

Difficulties in Industrial Costing: The Dilemma of Fixed Costs

Despite the convenience which standards offer, not all costs can be controlled by this means. There are many production situations which are not amenable to standardization: the one-time building of a special product to customer specifications, for example. In this case, _estimated_ costs are constructed as a basis for preliminary pricing, and as a spending guide.

A more universal difficulty, as the methods of production became more automated, is the predominance of fixed costs as a cost element. Today, the types of costs which once were major cost elements (hand labor and direct materials) and which were measurable and controllable at the individual level, have become less significant. But fixed costs (such as amortization of equipment cost, maintenance, supervision, insurance, personal property taxes) have become very significant. Automated production has a high capital investment; the largest single cost element may be amortization of equipment cost. In other cases, it may be overhead in its various forms.

The ultimate consequence of the change from direct-cost methods of production (labor by individuals) to indirect-cost methods (production by expensive, integrated machines), was that emphasis in production necessarily changed from minimizing unit cost of production to maximizing production volume from existing plant and equipment. As long as plant was kept producing at some product price above measurable direct costs, any price-cost difference would make some contribution toward fixed costs. Hopefully, by creating and selling enough units, all the costs could be recovered and some profit generated through sales revenues.

This change in production and pricing objectives brought changes in costing objectives. Now it became not only important to identify inefficiencies or dis-economies in production, but to identify that sensitive point where direct costs are covered, below which no product will be priced, and above which additional business will be sought.

Accountants had long been conditioned to "full costing" or "absorption costing" whereby all production costs, both direct (identifiable) product costs and indirect (not product-related) costs were attached to the product. Direct costs were attached by specific identification with product units; indirect costs by allocation on bases which appeared to bear some relationship to product units. Sometimes, full costs were used in pricing; more often, they measured only the profit (or loss) consequences of pricing, since prices are largely set by market forces external to the particular producer. The primary use of full costs, from an accounting viewpoint, was to value inventory for income measurement.

Under the pressures to maximize capacity utilization, accountants were forced to adopt a changed approach to product costing. This approach is called "marginal" or "direct costing." Those costs specifically identifiable with the product (direct materials, direct labor, and such overhead elements as can easily be associated with the product) are included in product costs. All other costs of operating the manufacturing enterprise are treated as period costs and are not included in product cost. "Period cost" means that such costs are more a function of the passing of time than of the kind or amount of production.

Marginal costing data is particularly useful in pricing extra business. Where products sold through normal channels at normal prices will not fully occupy productive capacity, firms will bid on additional large orders for different marketing channels on a reduced-price basis (but not below the marginal cost of production).

Accountants are not agreed on the virtues of marginal costing for inventory valuation because: (1) it conflicts with the notion that all facilities, both direct and supporting, exist to create product; and, (2) its acceptance by Internal Revenue Service as a basis for measuring taxable income has been quite limited.

Relevant Costing

Relevant Costing is a more moderate treatment of fixed costs. Under this notion a particular cost element which has significance for a particular action purpose will be included in product cost; if it does not affect that action it is ignored. Thus, in a decision to accept or reject marginal (extra) business, fixed costs could be ignored, because their incurrence would not be affected by the decision. On the other hand, if the marginal business would require additional plant or managerial personnel--a long-term commitment resulting in periodic fixed costs--fixed costs certainly are an element to consider. For cost control purposes at the lowest operating level, attention would center on variable (direct) costs immediately identifiable with the product, and long-run fixed costs would be ignored. For cost control purposes at the policy-making level, those commitments either for long term salaried employment, which result in future fixed costs or immediate out-of-pocket costs are relevant. The appropriate cost data is that which is relevant to the proposition being considered.

Cost Allocation

Many accountants agree that costs must be controlled at the point where they are incurred, and that cost control resides in planning for cost incurrence based on the task to be done. At the same time, it is desired to have product costs that contain at least a reasonable amount of all relevant costs regardless of where incurred. Because incurrence of cost may be only remotely connected with specific product outcomes, procedures are developed for reassigning costs from the point of incurrence to ultimate products. This process may entail a series of allocations and re-allocations. For example, when incurred, costs are in the form of natural expenses or objects of expenditure, such as gasoline, salaries, paper, telephone calls, supplies, etc. They must then be identified functionally, as pertaining to maintenance, production, selling, administration, financing, etc., in order to measure the costs of accomplishing these necessary functions. But since products come only from the production function, the costs of supporting functions such as purchasing, personnel, and maintenance, must be reassigned to the various productive divisions or departments. Finally, production costs, including those transferred from supporting activities, are assigned to products on some systematic basis.

Typically, products pass through a sequence of departments on the way to completion, and the pattern of component usages and therefore overhead assignments varies from department to department. Cumulative costs are embodied in the product and passed along with the product as it progresses through departments toward completion. The end result is an agglomeration of some carefully detailed experienced costs and some allocations and re-allocations, to reach what we call "final product cost." No one knows better than the accountant that this product cost is an approximation, even in the best of cost accounting systems. The process of cost allocation makes it so.

The Mechanics of Cost Allocation

In order to get service department costs assigned to departments which work directly on the product, and thence reassigned to product units, a systematic procedure has been used by accountants to eliminate service departments one by one until all their costs have been allocated to producing departments. Although such service departments as Payroll and Operations and Maintenance perform reciprocal services, this fact is ignored in the traditional allocation procedure for the sake of relative simplicity. To incorporate all these reciprocal service relationships in cost allocation calculations would require solution of unwieldy sets of simultaneous equations. As we shall see in Part IV-D, this is no longer the tedious algebraic task it used to be because solutions of simultaneous equations are now quick and easy on a computer. At this point, however, we shall concern ourselves only with the traditional service department elimination procedure.

Suppose that we have four service departments:

ES - Employee services (personnel and payroll)

ST - Stores

OM - Operations and Maintenance

UT - Utility Services

and three production departments, A, B, and C.

Suppose, also, that the records showed the following relevant data:

Exhibit 2-1

Basic Data for Cost Allocation

	ES	ST	OM	UT	A	B	C	Total
Number of employees	10	4	8	5	60	30	13	130
Value of stores requisitions (Thousands of $)	2	-	32	6	252	72	36	400
Value of Shop Work orders (Thousands of $)	3	3	-	10	32	20	12	80
Space Occupied (Thousands of Sq. Ft.)	4	10	8	10	44	16	8	100
Direct Costs Recorded (Thousands of $)	80	40	96	75	--	--	--	---

The department which draws the fewest services from other service departments will be allocated first; the one drawing next fewest services will be allocated second, and so on. The cost allocation pattern is shown in Exhibit 2.

For each producing department the amounts received by allocation will be added to departmentally incurred costs to establish the total amount of cost applicable to this department's current production.

For example, in the accompanying illustration, Department A received $172,574 of allocated costs. A complete cost schedule for A, for the accounting period, shows:

Departmentally incurred costs:	
Materials used	$89,093
Salaries and Wages	216,208
Miscellaneous expense	22,125
	$327,426
Allocated from service departments	172,574
Total production cost	$500,000
Units produced in dept.	2,500
Cost per unit this period in this department	$200

Exhibit 2-2

Cost Allocation by Successive Elimination

	Service Departments				Producing Departments		
	ES	ST	OM	UT	A	B	C
Costs to be allocated	80,000	40,000	96,000	75,000			
Allocation of ES (Basis: Number of employees)	(80,000)	2,667	5,333	3,333	40,000	20,000	8,667
Allocation of ST (Basis: Value of stores requisitions)		42,667 (42,667)	3,430	643	27,017	7,718	3,859
Allocation of OM (Basis: Value of Shop Work orders)			104,763 (104,763)	14,157	45,304	28,314	16,988
Allocation of UT (Basis: Space occupied)				93,133 (93,133)	60,253	21,920	10,960
Total service department costs allocated to producing departments					172,574	77,952	40,474

Distribution Costs

The subject of distribution costs in industry has a peculiar parallel in higher education. By distribution[1] costs we mean the costs of getting products into the hands of ultimate users, and in this category we include costs of inducing demand as well as costs of servicing that demand after it is aroused. There is a unique dichotomy of purpose in distribution costs: some of them are incurred in order to get orders, others are incurred because orders have been obtained. We look at the first kind of cost from the viewpoint of how effective it is in getting orders. We look at the second kind of cost from the viewpoint of efficiency in getting a pre-established job done. Demand-creating, order-getting expenditures determine in part the size of the job (producing and delivery) to be done; order-servicing costs are determined by the size of the job.

A parallel in higher education can be seen. At the same time that we must be concerned with economy in instructing present students, and in various non-teaching operations, we must be using money and efforts to engage the attention of the kinds of students and faculty whom we wish to associate with the institution. Similarly, much effort is expended in creating market demand for research as a product, because research opportunities are in turn a device for attracting forward-looking, ambitious faculty who in turn will have an impact in producing superior degree holders and in building the public image of the institution. These demand creation efforts in turn affect the job of servicing students, either in terms of numbers or types of educational experiences which they demand.

---

[1] These are often described as "marketing costs," with the term "distribution costs" being restricted to the physical movement of goods.

Costing Principles Applicable to Higher Education

We review here a few basic notions about costing, which are valid in industry or in education.

(1) Costs attach. They are incurred for the purpose of doing something or making something; costs represent efforts which result in services performed or which become embodied in Things. Costing procedures provide ways by which costs attach to things or to functions performed. Because input efforts sometimes relate only remotely to outputs, cost attachment procedures often are quite arbitrary.

(2) Costs originate in cost centers. Organizations are complexes of cost centers; most cost incurrences, initially at least, can be identified with some specific jurisdictional unit or work group or place. Cost center boundaries are the points at which a thing or a service is transferred to another jurisdiction, and at which that transference can be observed or measured or counted or sensed.

(3) Most costs are joint costs. A given cost incurrence usually will serve several products or functions. For example, a university's burning of coal in powerhouse produces steam and electric power. Steam is used for space heating, for cooking, for laboratory experiments, for hot-house plant experiments, for physical therapy, for dairy plant processing, for heating swimming pools and even for freezing ice! Electric power generated likewise goes for numerous joint uses.

Steam for space heating goes to many buildings. One such building contains classrooms and offices for several departments, and laboratories. The classrooms are used for all departments' courses. The laboratories are used for instruction and for thesis research and for faculty research. Thus we see that even a clear-cut purchase of a simple thing like coal constitutes a joint cost.

Our experience with studies of professorial time usage show that instructional salaries too are a joint cost, although we pretend that they are all spent for instruction. Actually, only 40 to 70% of the typical professor's time is taken up with work related to instruction. The remainder goes to research, public relations, talks, administration, assistance to colleagues, businesses and/or farmers, and other individuals needing help, recruitment, placement, and some time to writing.

(4) Control of costs can only be done before the fact of incurrence, not afterward. Afterward is too late. The usefulness of experienced cost data is in establishing relationships between outputs and specific kinds of efforts (inputs). Control lies in establishing in advance what resources are necessary to get the job done effectively, and in identifying the use of resources with specific persons who are in a position to manage their use. Follow-up by higher authority is also necessary, to assure that responsible persons have adhered to plan (or to assure that departures from it have been for valid reasons).

(5) Costs are seldom linear. By linear costs, we mean that increases in a particular cost element (such as supplies used) would rise in direct proportion to increases in size of the task (such as number of student enrollments in a department). If we were to plot quarter-by-quarter expenses relative to a course, against enrollments, we would find some expense items directly proportional (Figure 2-3A) (linear), other somewhat scattered (Figure 2-3B) (variable but not necessarily linear), and others independent of enrollment (Figure 2-3C) (fixed costs). Others are fixed over narrow ranges of volume but variable over wide ranges of volume (step costs).

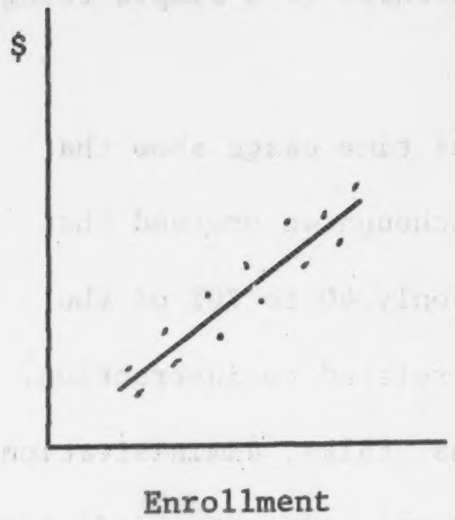


Figure 2-3A

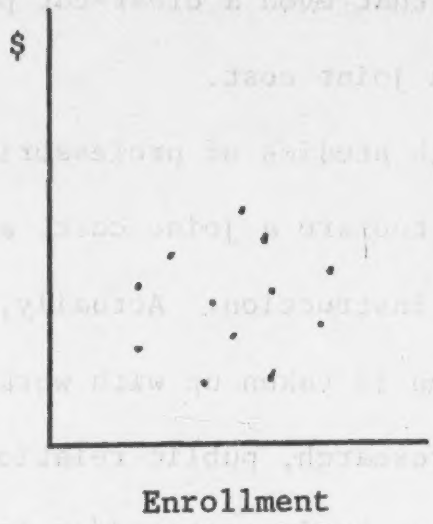


Figure 2-3B

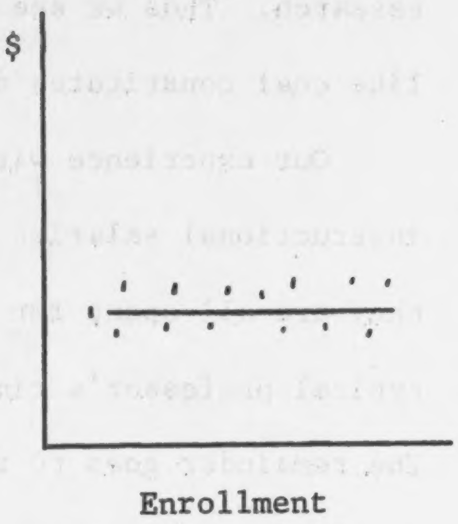


Figure 2-3C

Because of differing relationships of individual expense categories to the volume (of production in industry, or of enrollments in education) it is necessary, for planning purposes, to make studies of individual expense categories separately. In order to do this, it is necessary to maintain historical records of expense categories in sufficient detail and for a sufficiently long time that the expense-output relationships can be constructed. Such records (except as recorded in budget categories) are not generally existent in universities. We have not been concerned enough with input-output relationships to require the keeping of such detailed records. There is no reason why, with appropriate transaction coding, it could not be done as a regular by-product of budgetary accounting, using mass record-keeping equipment now available. It is technically feasible; the question remains whether the getting of extensive detailed information is worth the burden it would impose upon originators of accounting data.

(6) Not all relevant costs appear in the accounts. The notion of opportunity cost is important in considering alternative uses of any resource. If space in a retail store is used for display of camping trailers, it is not available for the display of shirts. If a faculty

member's time is used for research, it is not available for teaching. The cost of its use for one purpose is valued by the sacrifice of the lost opportunity to use it in another way. In industry, managers are sensitive to the opportunity cost notion, even if they never heard of it as such. They know that to tie up funds in an investment yielding 3% sacrifices the opportunity to earn 8% on some other investment. Yields (in terms of interest earned, or in terms of output per unit of scarce resource used) serve as a device for allocating resources. Thus it is important that educational costing concern itself with yields (whether economic, physical, or social), as well as with costs.

(7) Job costs vs. process costs.

There are two basic costing structures, in product costing, which conform to the physical nature of the related production process.

In job costing, production is for an identified job or customer, and all usages of labor, supplies, etc. pertaining to the job are identified and posted to a record of costs for the job. In addition to identified costs, an allocation of supporting activity costs ("overhead") is assigned to the job, to complete its cost picture.

In process costing, large numbers of units are turned out en masse, and costs are accumulated for the process as a whole. Periodically, total costs (including an allocation of overhead) for the process are divided by the number of units produced, to obtain an average unit cost. Modern assembly-line production is subject to process costing.

University operation is a combination of job order production and process-type production. Its research activities tend to be identifiable by projects, roughly comparable to customer orders in industry, with specifications and efforts uniquely directed. Its educational efforts resemble assembly-line operation, with large numbers of units being processed through rather uniform sequences of operating steps. There is, even among such mass products as automobiles and college degrees, some product differentiation. Auto buyers are charged price differentials for these options; academic degree-seekers may or may not be charged for them although typically they are not.

(8) All costs are controllable at some level of administration. People make the decisions; people are responsible for cost incurrences, for buying and using things and services. At each level--the instructor, department head, dean, president--there are costs which can be managed by the person in charge. Instructors can plan their preparation of materials in order to make efficient use of typists and mimeograph rooms, to avoid up-and-down peaks in staffing. Department heads can assign faculty and schedule courses to make best use of available talent. Deans can make policies on scheduling classes, which will economize on the use of scarce classroom space. Presidents can establish priorities for university activities, which will channel faculty effort into directions which hopefully will produce greatest academic, economic, or social yield from a given set of university resources.

Instructor-level control actions are short-run actions in specific circumstances. At higher levels, control actions are long-run actions in the shape of policy-making.

Every cost should be identified as the responsibility primarily of one person, he who is in the most likely position to have an influence over it.

For product costing it is useful to have common or joint costs allocated to cost centers and thence to products; but cost allocation obscures the responsibility for cost incurrence. For cost control it is desirable that measurement be made by responsibility rather than by product. For cost control, each responsible individual is charged only with the management of those costs which he can largely influence. Thus, in a university, we tend to cling to budgetary or jurisdictional accounting, because here, at least, is a visible relationship between authority, responsibility, and cost incurrence.

Institutional Cost Studies

Attempts to discover costs of instruction are not new. For example, at Michigan State University the Office of Institutional Research has been providing departments with statistical data for several years, covering class sizes, faculty loads, section size analysis, and other comparative data. While these resource usage reports are not in dollar terms, they do reflect the employment of the most costly resource (faculty time) in instruction. Included in the analysis is a breakdown of faculty time for each department, based on ex-post gross estimates made by faculty members themselves. Four categories are reported in these faculty functional categories of time usage:

1. Instruction. Activities involved in teaching fixed and variable credit-undergraduate and graduate-courses, including preparation, evaluation, and student conferences; academic advising; direction of or consultation on dissertations; service on doctoral committees; course, curriculum and program planning; and other activities associated most directly with the instructional program.

2. Research, Creative, and Scholarly. All research, creative, and scholarly activities, excluding class preparation and preparation for professional service activities. Includes planning, carrying out, and reporting of individual or departmental (including "All University" supported) research; professional writing; and artistic and other creative activities.

3. Professional Service. Activities in which the faculty member's professional competence is made available to the general public or to special groups. Includes non-credit Continuing Education activities; speeches and direct service to lay groups or individuals; unremunerated consultation within or outside of the University; radio and

television appearances; and editorial or committee service to scholarly or professional organization.

4. Administration and Committee. Committee and other activities related to general administration at the department, college, or university level. Committee activities that can be specifically associated with instruction, research, or professional service should be reported in the appropriate one of the prior three categories.

Although the Office of Institutional Research produces many other kinds of report data, a sampling of the resource-usage type of data generated by college and department, follows:

	Report Title	Type of Data Included
1.	Analysis of Instruction and Faculty Load Reports (Produced Fall 1960 through Spring 1962)	Credits of Teaching; class hours taught; number of courses taught; student credit hours; full-time equivalent faculty in instruction; average section size; average credits per FTE faculty; student credit hours; salary cost per student credit hour, etc.
2.	Section size analysis	Summary of percentage of credits taught at specified section size intervals
3.	Instructional productivity and faculty time distribution	Superceded #1 above, beginning in Summer 1962, through Spring 1963 Same data as #1, basically
4.	Volume of Instructional Analysis (Beginning Fall 1962 and continuing through 1964-65)	Number of courses; enrollments, class hours, student credit hours, etc.
5.	Teaching Load and Time Distribution Analysis (Beginning Fall 1962 and continuing through 1964-65)	Distributions and averages of credits of teaching; student credit hours per FTE faculty; percentage distribution of faculty time.

Although several years ago an attempt was made to convert salary data and teaching load data into Cost of Instruction per Student Credit Hour, for the various educational levels (undergraduate, Masters, Doctors), these figures are not included in current OIR reports. It was found that the breadth of assumptions necessary to convert salary figures into course costs made the apparently precise "cost per student credit hour" highly imprecise in actuality. Secondly, the costs generated were only direct salary costs; the omission of administrative, facility, and other supporting costs made the instructional cost figures quite incomplete.

The OIR reports, while not cost reports in the strict sense, are useful in comparing resource usages and/or yields (in student credit hours) among departments. Much more detailed time reporting, identifying specific functions and courses, would make the OIR reports more complete and more useful in identifying overloaded or understaffed instructional areas.

Literature on Cost Analysis

The Annotated Bibliography (attached to this report) shows several attempts to derive unit instructional costs. Usually when instructional cost figures are shown they refer only to salary costs and do not include facilities and materials nor amortization of development costs. Among the references which suggest techniques for finding unit instructional salary costs are Doi, Florida Board of Control, Hubbard, Jedamus Kettler, National Committee on Standard Reports for Institutions of Higher Learning (1935), Russell, and Tyndall and Barnes.

Also reported are a few efforts to cost out the use of Closed-Circuit Television for teaching. Among the pertinent Bibliography references are Carpenter (1958), Carpenter and Greenhill (Report No. 2, 1958), Erickson and Clauson, Greenhill (1963), McIntyre and Paden, and Seibert.

A survey of these sources shows that techniques for cost analysis are really not lacking. What is lacking is a way to avoid arbitrary assignment of costs to functions or courses, given existing accounting structures, the state of the data processing art, and the absence of detailed data on which to base any precise cost identification. The techniques for unit cost finding, proposed by the National Committee on Standard Reports in 1936, are still valid as a basis for cost analysis. We do not yet have a way to make detailed cost identifications without a degree of minuteness in reporting resource usages which we (university faculties and administrators) appear to be unwilling to accept.

IV

CURRENT COSTING EFFORTS

A considerable amount of effort has been expended in trying to arrive at educational costs on a unit cost basis, as shown in the discussions above on studies found in the literature and in the material on Institutional Studies. In the present project, further cost searching was done, but this time with the attempt to include all costs of a particular instructional effort including not only salaries, but pro-rata portions of administration, supplies, amortization of equipment costs, and occupancy. Particular attention was given to the use of CCTV as a growing medium in higher education, and an expensive one which has had insufficient attention as far as its costs of application to particular courses are concerned.

Cost elements in CCTV

Cost of CCTV usage, as it applies to any specific instructional use, consists of six elements:

1) a pro-rated portion of central TV facility costs, which attaches to courses on an hours-of-usage basis. The pro-ration rate will depend on whether the lectures are live, or are playbacks of previously recorded lectures.

2) a pro-rated portion of distribution costs, which attaches to courses on a student enrollment basis.

3) permanent faculty time for lecturing and supervision.

4) supporting personnel (proctors and assistants).

5) special materials (film clips, graphics, exam materials, etc.).

6) occupancy costs.

By assembling a "cost package" containing these elements in the amount of their proposed incorporation in any given course, one can arrive at a crude but (we think) reasonable basis for judging the economies or diseconomies of TV instruction for that particular course. As cost analysts, we do not presume to judge the educational appropriateness, nor acceptability to faculty and students. Costs, educational effectiveness, and organizational consequences are all relevant issues to be weighed by university administrators.

The discussion of CCTV at Michigan State University will take the following pattern in this chapter:

1) Determination of cost elements
   a) originating costs
   b) viewing costs
   c) staffing

2) Sample construction of costs for a theoretical CCTV course, with varying size assumptions.

3) Case history: the Principles of Accounting course

Determination of Cost Elements

On the assumption that the studios and central control facilities, including office personnel and facilities, engineer, camera costs, amortization of recording equipment, etc., exist mainly for instructional use, we assigned the total cost package therefor to the two areas of instruction and special projects. For the most part, costs for special projects have been rather carefully identified. The remainder, then, must reside in instruction.

We immediately dismissed the notion of "full absorption costing," i.e., dividing the total instructional TV cost package up among the courses which happened to use the service during a given year. This procedure would result in an uneven year-to-year unit cost (per credit hour or per student exposure hour) which would vary only because more or fewer courses were televised, and not because of variations of effectiveness or efficiency of presenting a course or in the management of the TV service.

Instead, we chose to devise a "normal volume" concept, stated in terms of "normal" (i.e., practicable) studio operating hours per time period. Similarly, a "normal" demand pattern for TV distribution service could be derived. There are several ways in which the latter can be done. One way is to predict how many likely takers there will be of the service, if past service usage behavior continues unchanged, and to calculate the number of hours of service they will ask for. Another way is to establish what the demand would be if all large-course lectures were placed on TV, thus establishing a "potential market," measured in terms of student exposure hours per year. A third way is to take the total viewing capacity in the existing system (i.e., number of seats available for the number of hours available), then "back off" from this "engineered" capacity to some notion of "practical" capacity (after allowing for schedule slippages, breakdowns, odd hours, seats in non-academic locations, etc.) to arrive at an average reasonable expected annual level of use.

Once having chosen "normal volume" as a basis, the fixed facilities cost is divided by this base to derive a "standard" hourly cost rate. Thus if a lecture course is to be offered 3 times a week for 10 weeks, the course will be charged with 30 standard hours of facilities cost.

The advantage of this costing convention--much used in industrial accounting--is that the unabsorbed facilities cost is disclosed. To the extent that sufficient use is made of the system, at the standard hourly rate, its full cost is "absorbed." If there are not enough takers of the service, some part of the facilities cost remains unabsorbed, and can be thought of as the penalty paid by the owning organization for failure to use the service to a desirable extent.

If departments offering courses by CCTV are to be charged with an interdepartmental charge for the service, it would be manifestly unfair to base the charge to them on the number of courses happening to use the service currently. It is not the fault of any one department that others choose not to televise. By the use of a standard hourly service charge, using departments can be charged equitably for the service at predictable rates.

If the total distribution cost is divided by the "normal" annual quantity of student-exposure hours, a variable rate is found which attaches to courses according to number of students viewing the telecasts. This procedure assumes that distribution cost should be absorbed linearly in relation to student-exposure; the idea being that the larger the course enrollment, the more cables, viewing sets, and space are necessarily used to service the course. Use of the studio and central controls is not proportionate to student enrollments, but to hours of operation on behalf of a course.

The particular institutional arrangement where this cost study was done is a cable network linking viewing rooms throughout a widespread campus to central studios. There are two studios and 97 viewing rooms, of which 76 can be used as viewing classrooms. Total viewing capacity in the 97 rooms is 5,542 seats; however, a normal viewing audience of only 2500 to 3500 can be expected in the 76 useful viewing rooms. While 45 hours of viewing per week is theoretically possible, an *average* daily viewing level is not likely to exceed 7 hours a day, or 35 hours a week, for only 30 weeks per year. Summer course volumes are small enough to handle in the traditional small-group way.

Live broadcast capacity is one of the limitations in the situation. Theoretically, both studios could broadcast live 45 hours a week. But to do so would require enormous staffs, and would permit (1) no special project work such as videotape preparation for circulation, (2) no time for broadcast via playback of previously taped materials or purchased and rented materials. Because of engineering time, coordination and staffing with program directors, technicians, etc., a more realistic view is that live broadcast capacity is limited to 40 hours a week from (the equivalent of) one studio. However, approximately one hour of studio non-broadcast time is employed for one hour of live broadcast time, with the practical effect that net available use per week is 20 hours for one studio for 30 weeks per year. The equivalent of one studio is then available for recording and for special events and special projects. A lot of lecture materials for the ensuing year can also be taped during the summer.

Video tape playback capacity is also a limiting factor. It was calculated here at 4800 hours per year (4 VTR's, 40 hrs. a week for 30 weeks).

In addition to the usual originating costs (live on-camera or tape playback), one must add specific equipment usage costs if extra equipment, such as a film chain, is employed for a given course. If the course has been taped, then projection costs for each showing of the course will include the amortization of the original production costs, on an hourly basis.

In addition to the usual distribution costs (cable transmission to rooms and viewing set upkeep, etc.), one must add specific equipment usage costs if extra equipments, such as talkback telephones are used in the viewing rooms.

In 1963-64, the institution had accumulated six years of experience with CCTV for instruction. Yet the degree of penetration into academic life had been comparatively small. Compare capacities with utilization for the year 1963-64:

Capacity		Usage
Theoretical	Practical	
Live transmission: 40 hours per week, 50 weeks per year = 2000 hours	20 hours per week, 30 weeks per year = 600 hours	400 hours
Playback capacity:	4800 hours	1080 hours
Viewing capacity:	76 rooms, average of 35 hours per week, seating up to 50 = 3,990,000 student exposure hours	273,020 student exposure hours
Potential demand: (all lectures in all courses over 400 enrollment 3,118,500 student exposure hours		

For purposes of our study, we used the following capacity bases for assigning the various cost packages to courses or classrooms:

Live telecast originating costs: assume that each studio is available 2000 hours per year, regardless of what it is being used for, and that a necessary crew includes Director, 2 cameramen, audio control and video control engineers, and floor director.

Tape recording and playback: assume that four VTR's are used 160 hours per week for 30 weeks per year.

Distribution: channel costs for 7 channels used are charged to 76 viewing rooms. Each viewing room is in use 35 hours per week for

30 weeks.

Specific cost data follow in Exhibits 4-3 through 4-7.

Some examples of unit costs under various assumed conditions are given in Exhibits 4-8 through 4-11, and 4-11a through 4-11g, to illustrate the application of the CCTV cost figures generated in Exhibits 4-3 through 4-7.

Exhibit 4-3

COST OF LIVE TELECASTS[1]

	Per Hour	
Variable Costs:		
Salaries	$ 28.02	
Repairs-2 hours @ 1.70	3.40	
Total variable costs		$ 31.42
Fixed Costs:		
Studios (Depreciation, utilities, and maintenance)-2 hours @ 2.04	$ 4.80	
Equipment-depreciation-2 hours @ 2.43	4.86	
Administrative and office expense - 2 hours @ 1.80	3.60	
Total fixed costs		$ 12.54
Total costs for producing a one-hour telecast		$ 43.96

---

[1] Does not include the lecturer's salary, or the cost of special materials which may be required for any particular production.

(Notes explaining assumptions follow.)

Notes to Exhibit 4-3

COST OF LIVE TELECAST

Salaries of Production Personnel (Includes fringe benefits):

Director	- 2 hours	@ 3.96 =	$ 7.92
Camera man #1	- 2 hours	@ 2.70 =	5.40
Camera man #2	- 2 hours	@ 2.70 =	5.40
Audio Control	- 1 hour	@ 1.30 =	1.30
Video Control	- 2 hours	@ 3.35 =	6.70
Floor Director	- 1 hour	@ 1.30 =	1.30
Salary cost to produce one hour of live television (excluding lecturer)			$28.02

Note: Floor director and audio control capacities will utilize student labor. ($25.61 per hour is charged to budgetary appropriations, and $2.41 is fringe benefit cost)

Repairs - Represents repair parts and cost to up-date and modify. Estimated at 10% of the original cost of the equipment ($68,000) per year, or $6,800. This amount allocated to the two studios at 2000 hours each annually is equivalent to $1.70 per hour.

Studios - Original cost of construction ($30,342) and the remodeling of facilities ($115,000) with a 20 year life is equivalent to $7,267.10 annual depreciation.
The cost for utilities and maintenance amounts to $901.18 (1564 sq. ft. @ $.5762).
Depreciation and utilities & maintenance is $2.04 per hour ($8,168.28 divided by 4000 hours).

Equipment - Original cost of equipment for Studio A and B is approximately $68,000. Assuming a 7 year economic life, depreciation amounts to $9,715.00 annually or $2.43 hourly.

Administration & Office Expense - It was assumed that 25% of Administrative and Office expense should be allocated to recording and live telecasts. This amounted to $7,182.10 or a cost of $1.80 per hour.

Exhibit 4-4

COST OF RECORDING TAPES[1]

Variable Costs:		
Salaries	$ 61.99	
Repairs-4 hours @ 1.70	6.80	
Total variable costs		$ 68.79
Fixed Costs:		
Studios-4 hours @ 2.04	$ 8.16	
Equipment Depreciation-4 hours @ 2.43	9.72	
Administrative and office expense - 4 hours @ 1.80	7.20	
Total fixed costs		$ 25.08
Total Costs to produce and record one 50-minute tape (excluding lecturer)		$ 93.87

---

[1] Does not include the lecturer's salary, or the cost of special materials which may be required in production, but would vary greatly from course to course.

(Notes explaining assumptions follow.)

Notes to Exhibit 4-4

COST OF RECORDING TAPES

Salaries (excluding lecturer) -

Director	- 4 hours @ 3.96 =	$ 15.84
Camera man #1	- 4 hours @ 2.70 =	10.80
Camera man #2	- 4 hours @ 2.70 =	10.80
Audio Control	- 4 hours @ 1.30 =	5.20
Video Control	- 4 hours @ 3.35 =	13.40
Floor Director	- 2 hours @ 1.30 =	2.60
VTR Engineer	- 1 hour @ 3.35 =	3.35
Cost of production personnel for recording and correcting one 50-minute film		$ 61.99

Repairs - Represents repair parts and costs to up-date and modify, at 10% of the original cost of equipment ($68,000) or $6,800 annual cost. This is allocated to two studios at 2000 hours each annually for a cost of $1.70 per hour.

Studios - Original cost of construction ($30,342) and remodeling of facilities ($115,000) with a 20-year economic life is equivalent to $7,267.10 annual depreciation. The cost for utilities and maintenance amounts to $901.18 (1564 square feet @ .5762). The total cost per hour therefore amounts to $2.04, based on 4000 hours of use.

Equipment - Original cost of equipment for Studeos A and B was approximately $68,000. Assuming a 7-year economic life, depreciation amounts to $9,715 annually, or $2.43 hourly.

Administrative and Office expenses - It was assumed that 25% of the administrative and office expense should be allocated to recording and live telecasts. This amounts to $7,182.10 or a cost of $1.80 per hour.

Exhibit 4-5

VIDEO TAPE PLAYBACK COSTS

Variable Costs:	Per Hour	
Cost of Video tape	$ 2.01	
Labor	3.95	
Replacement parts	2.39	
Video head assembly amortization	3.00	
Total Variable Costs		$11.35
Fixed Costs:		
Video tape recorder depreciation	$ 3.42	
Occupancy costs	.12	
Administration & office costs	4.50	
Total Fixed Costs		$ 8.04
Total VTR Playback costs per hour		$19.39

(Notes explaining assumptions follow.)

Notes to Exhibit 4-5

VIDEO TAPE PLAYBACK COSTS

Cost of Video Tape - A 4800 foot reel of tape will accommodate a 50-60 minute telecast, and costs $201.46. The manufacturer states that the tape meets the specifications of 100 replays. The tape can be erased and reused should the original recording be considered obsolete. There is no empirical data available to substantiate the life of the tape, so we rely on the manufacturer's representation. Therefore the cost of one replay would be $2.01.

Labor - Three closed circuit engineers are required to operate and maintain two Ampex 1000 C VTRs, two Ampex 1500 VTRs, and one film projector, at an annual rate of $18,900 (including fringe benefits). Usage per week is assumed to be 160 hours (1 VTR to be used as a spare, and for recording) for 30 weeks per year. Therefore the cost per hour is $3.95.

Replacement Parts - Assumed to be 10% of original cost per year in order to update, modify, and repair. Normally we expect that costs are actually lower than this in the first years of life, and higher as the equipment approaches retirement. Cost of this equipment is approximately $115,000. The annual replacement parts would cost $11,500, or $2.39 per hour, based upon 4800 hours of usage.

Video Head Assembly - $3.00 per hour represents an average for the present equipment. The Ampex 1500 VTR costs approximately $6.00 per hour for head assembly, whereas the Ampex 1000 C VTR is approaching $1.00 per hour because of recent improvements.

Video Tape Recorder - The cost of the five units used for playback is approximately $115,000. Assuming a sever-year life, which is lower than the life used in many cost studies, but is justified by the rapid obsolescence factor experienced in this field, annual depreciation amounts to $16,430, or approximately $3.42 per hour of playback (based on 4800 hours per day).

Occupancy Costs - Building depreciation is $349.20 per year for 360 square feet in the video control room at $19.40 per square foot (assuming a 20-year economic life). Building maintenance and utilities amount to $207.43 annually, using $.5762 cost per square foot. Spread over 4800 hours, occupancy costs total $.12 per hour of playback.

Administrative Costs of CCTV - 75% of the total administrative and office expenses have been allocated to playback costs of video tape recorders, amounting to $21,546 per year, or $4.50 per hour of playback.

Exhibit 4-6

CLASSROOM COSTS PER STUDENT CCTV EXPOSURE HOUR

	Classroom cost Per Hour	
Variable Cost:		
TV Outlet Rentals	$ .02	
Channel Charges	.13	
Maintenance of Sets	.07	
Student Classroom Engineer	.08	
Proctors	3.50	
Total Variable Costs		$ 3.80
Fixed Costs:		
Television Set Depreciation	.09	
Utilities and Classroom Maintenance	.37	
Classroom Depreciation	.26	
TV set Repair Center Costs	.01	
Total Fixed Costs		$ .73
Total Classroom Charges per Viewing Hour		$ 4.53

Average classroom size: 50 seats

Class size	Cost per student Exposure Hour
50	$.09
45	.10
40	.11
35	.13
30	.15
20	.23
10	.45

(Notes explaining assumptions follow.)

Notes on Exhibit 4-6

CLASSROOM COSTS

Outlet Rentals - 2 per room @ $1.25 per month each. Assuming that classrooms are in use 35 hours per week for 30 weeks, and 20 hours per week for 10 weeks during the summer. Outlet costs may be terminated if not used for a quarter. Rate is $30.00 per year, divided by 1250 hours, equivalent to approximately $.02 per hour.

Channel Charges - (Modulators, amplifiers and RF rentals) Based on the use of seven channels, includes the cost only for buildings utilized for instructional purposes. It was assumed that the average distance from the studio is one-half mile (a little high) and that each building can handle three channels (a little low for some buildings), over-all should be a close approximation. Monthly rental fee is approximately $850.00, with 76 viewing rooms available, giving $11.20 per month for an average room, or an annual charge of $134.40 per room. With usage based upon 35 hours per week, 30 weeks per year, the average cost would be $.13 per hour.

Maintenance of Sets - It is assumed that it will require one full-time employee's efforts to amintain the television sets when the number of sets reaches 200. This will involve $6,000 annual salary plus an allowance of 10% for fringe benefits ($600). The total remuneration of $6,600, divided by 200 sets, gives an average annual cost of $33.00 per set for labor. Parts (tubes, transportation, etc.) are assumed to cost 5% of the original cost of the set per year. Two sets per room are required.

Labor @ $33.00 per set	$66.00
Parts (5% of $185 per set)	1.85
Total annual cost	$67.85

Average usage is assumed to be 1050 hours annually, giving an hourly rate of $.07.

Student Classroom Engineer - It is assumed that a classroom engineer is required in four buildings (Auditorium, Bessey, Giltner, and Erickson) for 160 hours per week for 30 weeks at $1.25 per hour, or an average of $.08 per hour per classroom.

Proctors - A charge of $3.50 per class hour was assumed, which represents a combination of individuals with varying degrees of proficiency and hence different duties and rates.

Television Sets - The average cost of a television set and stand is $185.00. A four year life has been assumed, with an average use of 35 hours per week for 30 weeks per year. The life is lower than often assumed in other studies. The reason for our assumption was to include such factors as obsolescence, rough usage in some room, etc. The cost of two sets per room, based on the above usage is $.09 per hour.

(Classroom Costs - Continued)

Utilities and Maintenance of Classroom - The average classroom size is 797 sq. ft. The cost of maintenance, heat, light, janitorial service, and fire protection per year per sq. ft. is $.5762, or an annual cost of $459.23 per room. If usage is at an annual rate of 1250 hours, this would amount to $.37 per hour.

Classroom Depreciation - The average construction cost for a 50 seat classroom is $13,059.00. Assuming a 40 year life, annual depreciation amounts to $326.48. A usage of 1250 hours gives an hourly rate for depreciation of $.26.

Utility, Maintenance and Depreciation on Television Set Repair Center Annual building depreciation is $873.00; heat, light, water, maintenance, and janitorial service is $518.58 (assuming .5762 per sq. ft.). Dividing these total costs by the 200 sets to be maintained, based on usage of each set of 1050 hours per year, results in $.01 per classroom hour.

Exhibit 4-7

ADMINISTRATIVE AND OFFICE EXPENSES FOR CCTV

Actual expenditures for 1963-64:		
Travel & Transportation	$ 2,100.69	
Telephone, postage, supplies, misc.	2,352.09	
Salaries (Including fringe benefits	22,880.00	
Total charged to budget		$27,332.78
Non-budgetary costs:		
Building depreciation	$ 664.45	
Office equipment depreciation	336.17	
Office maintenance & utilities	395.70	
Total		$ 1,395.32
Total Office Expenses		$28,728.10

Cost Allocation:	
VTR Playback (75%)	$21,546.00
Live telecast & recording (25%)	7,182.10
	$28,728.10

Notes to Exhibit 4-7

ADMINISTRATIVE AND OFFICE EXPENSES

Building Depreciation - The office occupies 685 square feet, with construction costs of $19.40 per square foot. Assuming a economic life of 20 years, gives an annual charge of $664.45 for depreciation.

Office Equipment Depreciation - Given a total cost of $3,361.69, with an estimated economic life of 10 years, the annual charge for depreciation is $336.17.

Office Maintenance and Utilities - 685 square feet at the rate of $.5762 per sq. ft. is equal to $394.70 per year.

Exhibit 4-8

VIDEO TAPE PLAYBACK COST PER STUDENT EXPOSURE HOUR

No Classrooms Participating	Students per Classroom						
	10	20	30	35	40	45	50
1	1.94	.97	.65	.55	.48	.43	.39
2	.97	.48	.32	.28	.24	.22	.19
3	.65	.32	.22	.18	.16	.14	.13
4	.48	.24	.16	.14	.12	11	.10
5	.39	.19	.13	.11	.10	.09	.08
8	.24	.12	.08	.07	.06	.05	.05
10	.19	.10	.06	.06	.05	.04	.04
15	.13	.06	.04	.04	.03	.03	.026
20	.10	.05	.03	.028	.024	.022	.019

See Schedule III for total costs.

Exhibit 4-9

COST OF PRODUCING LIVE TELECAST PER STUDENT EXPOSURE HOUR

Includes Lecturer's Salary allocated to instruction, $10,800. ($^5/_8$ of a Full Professor)

Instructor's Contact hours per term	Number of Students in Course								
	100	200	300	400	500	750	1000	2500	5000
12	.74	.37	.24	.18	.15	.10	.07	.030	.015
10	.80	.40	.27	.20	.16	.11	.08	.032	.016
8	.89	.44	.30	.22	.18	.12	.09	.036	.018
6	1.04	.52	.35	.26	.21	.14	.10	.041	.021
5	1.16	.58	.39	.29	.23	.15	.12	.046	.023
4	1.34	.67	.45	.34	.27	.18	.13	.054	.027

Exhibit 4-10

AMORTIZATION OF VIDEO TAPE RECORDINGS

Cost of lecturer's time:

Lecturer's salary	$14,000	
Fringe benefits	1,400	
Total annual labor cost	$15,400	
Hours available: 36 weeks @ 40 hours each =	1,440	
Average cost per hour =	$ 10.70	

Total recording costs:

Lecturer's on-comers time, 4 hours @ 10.70	$ 42.80	
Lecturer's preparation time, 4 hr. @ 10.70	42.80	
Lecturer's salary cost of one hour of recording		$ 85.60
Recording Production costs		93.87
Total cost of recording a one-hour lecture		$179.47

Number of Replays	Cost per Replay
4	$ 44.87
6	29.91
8	22.43
10	17.95
15	11.96
20	8.97
25	7.18
30	5.98

Exhibit 4-11

COMPARATIVE COSTS PER STUDENT EXPOSURE HOUR USING VARYING TEACHING METHODS

Course method	Cost per student exposure hr. with 400 students	800 students
3 hrs/wk Live CCTV (Exhibit 4-11a)	$ .457	$ .369
3 hrs/wk CCTV Tape Replay (Exhibit 4-11b)	.376	.328
3 lectures/wk, 400 students per lecture (Exhibit 4-11c)	.406	.406
2 lectures/wk and one recitation/wk (Exhibit 4-11d)	.479	.329
1 lecture/wk and two recitations/wk (Exhibit 4-11e)	.496	.421
3 recitations/wk (Exhibit 4-11f)	.696	.696
3 hrs/wk Live CCTV, with taped replay of same to subsequent section (Exhibit 4-11g) (Note: This method lends itself well to courses with large enrollments. As shown in the schedule, the cost is reduced to $.265 where it is taped live and played back twice to accomodate a total enrollment of 2000 students.)		.392

Exhibit 4-11a

Cost per Course: 3 hours per week via live CCTV, 10 weeks

	400 students 10 viewing rooms	800 students 20 viewing rooms
Classroom costs ($4.53 x 10 x 30) (Includes proctors for each room @ $3.50 per hour)	$1,359	$2,718
Lecturer's time (approximately $14,000 straight salary plus fringe benefits; 72% of time devoted to instruction, and a 6 hour course load)	1,800	1,800
Cost of live telecast ($43.96 x 30)	1,319	1,319
Assistants		
2 Ph.D. candidates ½ time	1,000	
3 Ph.D. candidates full time		3,000
Total cost per quarter	$5,478	$8,837
Cost per student exposure hour	$ .457	$ .369

Exhibit 4-11b

Cost per course: CCTV Replay of Special Prepared Tape, 3 hours per week, 10 weeks

	400 students 10 viewing rooms	800 students 20 viewing rooms
Classroom costs (Includes proctors @ $3.50 per hr.)	$1,359	$2,718
Amortization of total tape production costs, assuming tape will be used a total of 8 times	673	673
Video tape playback costs	582	582
Lecturer's time for supervision (Assumes professor could supervise four such courses for each of three quarters, with annual instructional portion of his salary of $10,800)	900	900
Assistants:		
2 Ph.D. candidates ½ time	1,000	
3 Ph.D. candidates full time		3,000
Total cost per quarter	$4,514	$7,873
Cost per student exposure hour	$ .376	$ .328

Exhibit 4-11c

cost per course: Large lectures only, 3 hours per week, 10 weeks

	400 students 2 lecture sections	800 students 4 lecture sections
Classroom costs	$ 151	$ 302
Lecturer's time:		
One full time	3,600	
Two full time		7,200
Assistants:		
One Ph.D. candidate full time	1,000	
Two Ph.D. candidates full time		2,000
One student, 10 hours/week @ 1.25	125	
One student, 20 hours/week @ 1.25		250
Total cost per quarter	$4,876	$9,752
Cost per student exposure hour	$ .406	$ .406

Exhibit 4-11d

Cost per course: Two Lectures and One Recitation per week, 10 weeks

	400 students 2 lecture sections of 200 each & 8 recitation sections of 50 each	800* students 2 lecture sections of 400 each & 16 recitation sections of 50 each
Classroom costs	$ 151	$ 302
Lecturer's time	3,600	3,600
Recitation Instructors (2 Ph.D. candidates) (4 Ph.D. candidates)	2,000	4,000
Total Cost per quarter	$5,751	$7,902
Cost per student exposure hour	$ .479	$ .329

*Note: Lectures have been changed from 200 students per lecture to 400 students per lecture. If still taught with 200 per lecture, the cost per student exposure hour would remain $.479.

Exhibit 4-11e

Cost per course: One lecture and Two Recitations per week, 10 weeks

	400 students 2 lecture sections of 200 each & 8 recitation sections of 50 each	800 students 2 lecture sections of 400 each & 16 recitation sec. of 50 each
Classroom costs	$ 151	$ 302
Lecturer's time	1,800	1,800
Recitation instructors' time		
4 Ph.D. candidates full time		
8 Ph.D. candidates full time	4,000	8,000
Total cost per quarter	$5,951	$10,102
Cost per student exposure hour	$.496	$.421

Exhibit 4-11f

Cost per course: Three Recitations per week, 10 weeks

	400 students 8 sections of 50	800 students 16 sections of 50
Classroom costs	$ 151	$ 302
Permanent faculty time:		
(2-2/3 Assistant Professors full time-assume median salary of $8600, devoting 72% of time to instruction)	6,100	
(5-1/3 Assistant Professors full time-salary same as above)		12,200
Assistants:		
3 graduate assistants	2,100	
6 graduate assistants		4,200
Total cost per quarter	$8,351	$16,702
Cost per student exposure hour	$ .696	$ .696

Exhibit 4-11g

Cost per course: Live Telecast with Taped Replays of Same to Subsequent Sections in same quarter only

	800 students 20 sections of 40 1 live & 1 replay	2000 students 50 sections of 40 1 live & 1 replay
Classroom costs (includes proctors)	$2,718	$6,795
Cost of live telecast and taping ($43.96 x 30 hours)	1,319	1,319
Cost of replay ($19.39 x 30 hours per replay)	582	1,163
Lecturer's time	1,800	3,600
Assistants (3 Ph.D. candidates full time)	3,000	3,000
Total cost per quarter	$9,419	$15,877
Cost per student exposure hour	$ .392	$ .265

Staffing costs

CCTV as a device for carrying the same word to large numbers of students does not eliminate the necessity for supervision of student effort in an organized way. Indeed, it appears that the number of persons required may be larger than for traditional lecture-recitation methods; the composition of the staff is different. There must be technicians, there must still be persons who maintain contact with the student; evaluate his work; answer his questions, explain difficult points to those who do not get the message on first reading. Conceivably, students could voluntarily appear at viewing rooms, unsupervised, on schedule, listen, read, study, mark-sense their responses on IBM cards, receive grades by mail; never have contact at any point with human course supervision. It is too much to expect: students are people and they need direction from people, organization, stimulation, and some feeling that they are being taught by people. Thus, viewing room proctors are needed to supervise, grade, assist, organize, prod, reward, and react. However, they do not need to lecture. The one thing that CCTV does is to spread the talents of the experienced lecturer over large numbers of students. CCTV makes it possible, then, to use an experienced lecturer and a group of less skilled assistants to staff a course. Total staffing costs, then, can be assumed to be reduced by the substitution of assistants for senior faculty time, and the reduction may be replaced or more than offset by origination and transmission costs, depending upon the circumstances and conditions. As we will see in the Accounting case study, CCTV did not reduce instructional costs. Its validity could be found in the uniformity of instruction, the quality of lectureship reaching all course enrollees, and in the administrative convenience of stabilizing the course pattern under one lecturer for sequential terms.

If the course is set up for viewing room feedback to the lecturer, the number of viewing rooms is limited to the number that can be serviced well with questions and answers. The number is probably no more than 7 or 8 rooms for one lecturer. This means that for a course with large enrollments, a repeat lecture must be given. In contrast, where there is no talkback the number of rooms that can be serviced is limited only by the number of enrollees. Here is where, for very large enrollments, staffing (lecturer) salary economies can be hoped for. Similarly, although tape recordings generate initial production costs, the repetitive playing of tape to multiple lecture-viewing sessions, especially over several consecutive terms, promises substantial instructional staffing economies. Before we accept these promises too heartily, however, let us make some comparisons. For example, our figures show the cost of recording lectures on videotape at $94 per hour plus the lecturer's time (we estimate 4 hours @ $12 per hour), or about $140 for a 50-minute taped lecture. For a usual 3-credit, 30-class hour (per quarter) course, the cost of production would be $4200. Tape playback costs are $19 an hour. Thus to produce a taped course and use it only once would cost about $4770. However, its use per term would be only about $1620 if it were replayed 4 times per year. Distribution costs would depend, of course, on how many viewing rooms and sets were in use for each replaying. Basic distribution and occupancy costs, according to our figures, are $1.03 per viewing room per hour; thus for a course tape played to 10 rooms, basic distribution costs for a 30-session quarter would be $309; the total CCTV transmission costs, then, are about $1925 per term if the tape is used for four terms. In contrast, the live lecturer for a term of 30 sessions, spending 2 hours outside for 1 hour in lecture, spends about 90 hours at a rate of (let us assume) $12 per hour, or $1080 per term. Even using these crude figures, it is difficult to find CCTV economies even when original production costs are spread over a full year, unless a large enrollment is involved.

Studies in another part of this project showed an hourly rate basis for imputing instructional salaries. For a full professor, the earned rate was about $12.40 an hour, for associate professors, $10.25, for instructors, $4.00, and for graduate assistants, $3.33. No assistant professors were included in our particular study categories; but their rates can be imputed at about 80% of associate professor rates, or $8.25 per hour. These rates include the cost of fringe payroll benefits, which run at about 10% of stated salaries. For a particular institution, the contribution level to retirement plan will affect the fringe benefit cost substantially. In any case, the average salary levels for each of the grades should be examined in the institution; and if there are considerable internal variations in salary levels, perhaps it is best to consider specific salary levels of individual departments in the determination of CCTV staffing costs. The composition of labor mix we found to be important. (The use of seniors vs. assistant professors as viewing room proctors, for example, causes a substantial difference in cost of giving a course.)

With or without CCTV, staffing costs are the largest single cost element in managing large courses; they should not be excluded in any CCTV cost study.

Sample cost construction for a CCTV course

Let us assume, for purposes of illustration, that a particular 3-credit 10-weeks course has been offered to varying numbers of students from term to term. Enrollments range from 140 to 560, depending upon the term. The course has been staffed by a professor and an assistant professor during peak terms, for lectures, and by the professor during low terms. The recitation sections have been conducted by (graduate assistants) doctoral candidates, except that each professor holds one recitation section in a term when he is lecturing. The course has two 1-hour lectures a week and two 1-hour recitations. The lectures are typically to groups of 150 to 180; recitations are in classes of 30 to 50, with 40 an average size recitation group. Group examinations are given, which reduces the number of lecture periods from 20 to 18 per term. Terms are 10 weeks in length.

Proposal 1:

It is now proposed that in each term, the lectures be given on CCTV to the entire course enrollment at one time, in viewing rooms with 35 persons each. Immediately following the TV lecture, the recitation section will continue in the same rooms. Each room will be staffed by a graduate assistant during the lecture and recitation. The lectures are not taped. Examinations are given en masse, but in the viewing rooms.

Proposal 2:

All lectures should be put on video-tape, and played to the entire enrollment each term. Whenever there are more than 400 enrollees, a second replay of each lecture will be given at off hours and run to two viewing rooms for those who missed the lecture or want to hear it again. Examination procedure is as before. Videotape will be used for two years (amortization over 8 playbacks.)

Cost analysis for the present instructional method, and for the proposed use of CCTV, are shown below, based upon the following assumptions:

Professor rates are $12.00/hr., assistant professor $8.25/hr., graduate assistants $3.75 (these may include half-time instructors). The senior professor will supervise exam preparation in any case. Each recitation section requires 8 hours of time for giving and grading exams.

Lecture hall occupancy costs are 3 times those of classrooms.

Videotape production costs of $140 per 50-minute lecture, playback costs of $19 per 50-minute lecture, distribution costs of 40¢ per viewing room per hour, and occupancy costs of 63¢ per viewing room per hour are based on data given in Exhibit 4-3 through 4-7 and their supporting notes.

Exhibit 4-12

COSTS BY PRIOR LECTURE METHOD

	Enrollment per Term			
	140	280	420	560
I Origination	---	---	---	---
II Distribution	---	---	---	---
III Staffing				
Professor:				
Lecturing	$ 864	$ 864	$ 1728	$ 1728
Recitation	648	648	648	648
Exam Preparation	96	96	96	96
Grading	96	96	96	96
Assistant Professor:				
Lecturing	---	594	594	1188
Recitation	---	454	454	454
Exam Preparation	---	66	66	66
Grading	---	66	66	66
Assistants				
Recitations	675	1125	2000	2700
Examinations	88	150	240	360
	$ 2467	$ 4159	$ 5988	$ 7402
IV Occupancy				
Lecture Halls	38	76	114	152
Recitation Rooms	50	88	125	176
Total	$ 2555	$ 4323	$ 6227	$ 7730
Cost per enrollment	$ 18.25	$ 15.44	$ 14.82	$ 13.80

Exhibit 4-13

COSTS BY TELEVISED LECTURE

	Enrollment per Term 140	280	420	560
I Origination 18 hrs. @ $44	$ 792	$ 792	$ 792	$ 792
II Distribution .40 per room per hour	29	58	86	116
III Staffing				
Professor:				
Lecturing	864	864	864	864
Exam preparation	96	96	96	96
Exam grading	96	96	96	96
Assistants:				
Recitation	900	1800	2700	3600
Exams	90	210	330	450
	------	------	------	------
	2046	3066	4086	5106
IV Occupancy	101	202	303	404
Total	$ 2968	$ 4118	$ 5267	$ 6418
Cost per enrollment	$ 21.20	$ 14.71	$ 12.59	$ 11.46

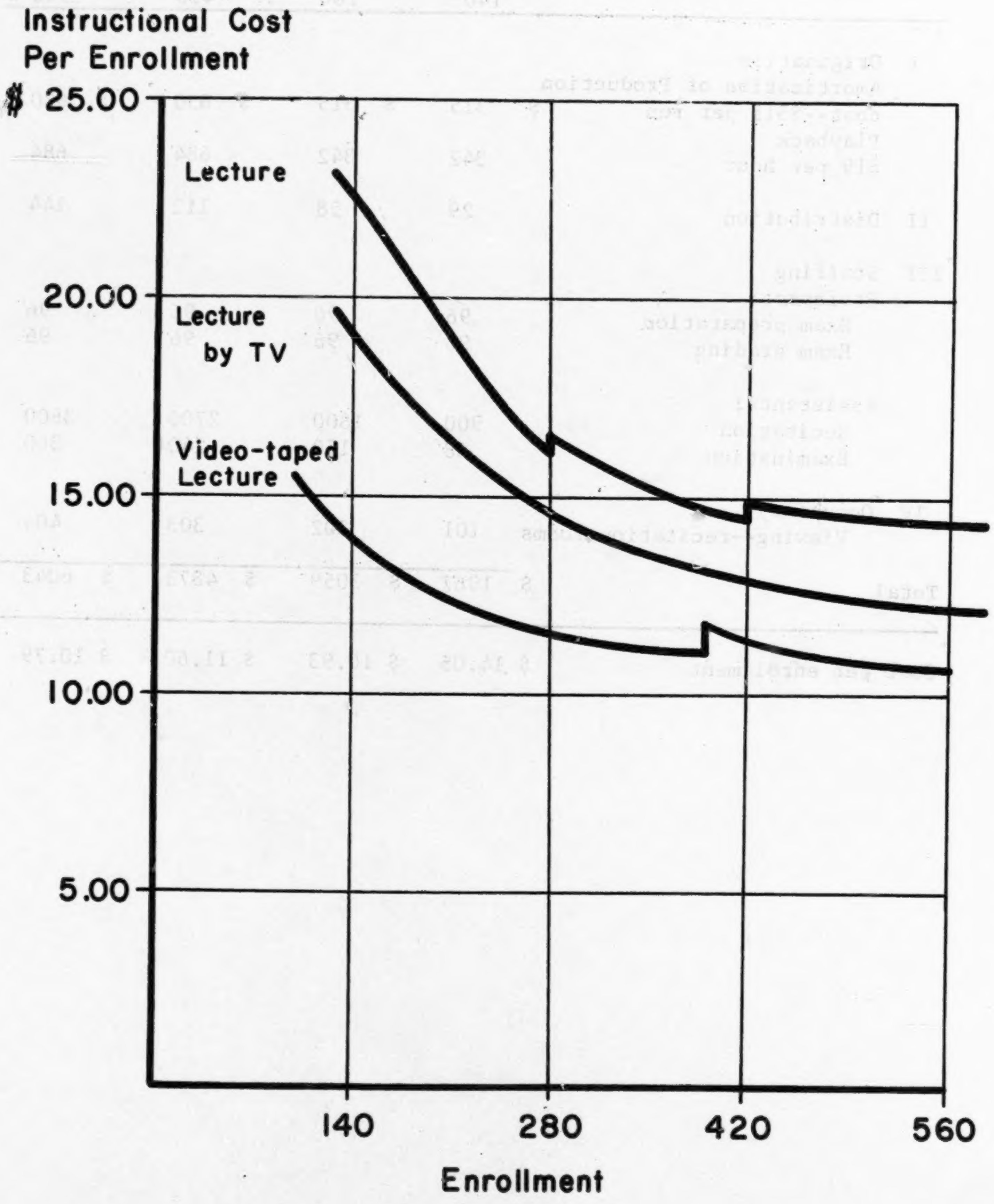
Exhibit 4-14

COSTS BY VIDEOTAPED LECTURES

		Enrollment per Term		
	140	280	420	560
I Origination				
Amortization of Production cost--$315 per run	$ 315	$ 315	$ 630	$ 630
Playback $19 per hour	342	342	684	684
II Distribution	29	58	112	144
III Staffing				
Professor:				
Exam preparation	96	96	96	96
Exam grading	96	96	96	96
Assistants:				
Recitation	900	1800	2700	3600
Examination	88	150	240	360
IV Occupancy				
Viewing--recitation rooms	101	202	303	404
Total	$ 1967	$ 3059	$ 4873	$ 6043
Cost per enrollment	$ 14.05	$ 10.93	$ 11.60	$ 10.79

FIGURE 4-A

COMPARISON OF INSTRUCTIONAL METHODS FOR VARYING ENROLLMENT-HYPOTHETICAL CASE



Media Usage Case History: Principles of Accounting Course by CCTV

Beginning in Fall quarter, 1959, the Department of Accounting and Financial Administration has offered its Principles of Accounting course by closed-circuit television. Lectures are given once a week in a non-TV large section. For this lecture, the professor makes extensive use of 2 x 2 slide illustrations to present sequences of accounting forms and entries. The same group of students is divided into recitation sections of 35-50 students each, for three meetings per week. Each of these sections is supervised by a graduate assistant, half-time instructor, or Accounting senior, but the session is conducted by the lecture-professor via CCTV. With the aid of a talk-back phone system, he conducts a question and answer session with students selected from the sections. No more than 8 sections are included in a hookup. Each session consists of reviewing previously assigned problems. Any student in any section may be called upon to answer a question or to explain his solution. Students may ask questions. All students in all sections can hear all the conversations and can see the professor on the TV monitor. Before or after the TV session, the section supervisor answers student questions. The professor and instructors maintained scheduled office hours during which students may have individual conferences.

Coordinated uniform examinations are given as they would be in a multi-section non-TV course with common lecture time. The following tables summarize the cost history of the two-term course sequence. There was also a third course in the sequence which was not converted to TV. The TV course data which follows is based on 3 years of operation, although experience goes back as far as Fall, 1959.

Effective Fall 1964, the three courses were consolidated into two and both were conducted via CCTV. With larger enrollments per course, it is expected that the average unit cost per credit hour should be further reduced.

Following the tables, two diagrams are given, representing total cost per quarter plotted against enrollments, and unit cost plotted against enrollments. Although the resource usage experience for large (i.e., 500 or more) enrollments per term is limited as yet, the pattern of past experience suggests that the volume-cost relationship is described by a modified-S-curve. The unit cost curve appears to be of the type xy = c, with the major inflection at around 300 enrollment. The subsequent consolidation of three courses into two, providing enrollments consistently above 350 per course, should permit a cost per student credit hour which is not likely to exceed $9.00 in any quarter and is likely to average slightly under $8.00. Costs shown are all-inclusive, containing apportioned fixed facility costs as well as out-of-pocket direct costs.

Motivation for the move to CCTV for this course was not economy, but the need to cover a vastly increased enrollment with unimpaired instructional quality, with no increase in permanent faculty positions. This objective was achieved. Uniformity of instruction, careful preparation, and exposure of all students to the senior professor, are products of the change in method of instruction. Low unit cost is a desirable by-product.

Exhibit 4-15

AFA 210-Principles of Accounting
Instructional Costs by CCTV

	Fall 61	Winter 62	Spring 62	Fall 62	Winter 63	Spring 63	Fall 63	Winter 64	Spring 64
Originating Cost, studio broadcast @ $44/hr.	$ 4356	$ 1452	$ 1452	$ 4356	$1452	$ 1452	$ 2904	$ 1452	$ 1452
Distribution @ 40¢ per room per hour	648	96	60	252	120	60	192	108	60
Staffing (Schedule I-B)	10460	5449	4339	10656	4761	3881	9113	5188	3816
Occupancy - lecture rooms @$1.89 per hr.	57	19	19	57	19	19	38	19	19
- recitation rooms @ $.63 per hr.	340	151	95	397	198	95	302	170	95
Special effects: talkback phones @ $127.50/month (Shared with AFA 211)	287	127	191	287	127	191	255	127	191
Slides, graphics (amortization and rework) (est.)	60	60	60	60	60	60	60	60	60
Slide projector rental									
Other - Secretarial (est.)	80	80	80	80	80	80	80	80	80
Total	$16288	$ 7434	$ 6296	$16145	$ 6808	$ 5838	$12944	$ 7204	$ 5773
Cost per enrollment	$24.09	22.66	38.61	22.80	19.08	30.36	18.70	22.30	34.57
Cost per student credit hour	$ 8.03	7.55	12.87	7.60	6.36	10.12	6.23	7.43	11.52

Schedule I-A

"Supporting Data for Exhibit 4-15"

	Fall 61	Winter 62	Spring 62	Fall 62	Winter 63	Spring 63	Fall 63	Winter 64	Spring 64
Enrollment	676	328	163	708	357	159	692	323	167
No. lecture sections	3	1	1	3	1	1	2	1	1
No. recitation sections	18	8	5	21	10	5	16	9	5
Hours non-TV lecture	30	10	10	30	10	10	20	10	10
Hours CCTV	90	30	30	90	30	30	60	30	30
Staffing, recitation sections									
Seniors		1	1	5	9	3	5	5	4
Graduate Assistants	3	2	1	3	1	2	2		
½-time Instructor	15	5	3	13			8	4	1
Professor							1		

Schedule I-B

Staffing Data For Exhibit 4-15

	Rate per hour	Fall 1961		Winter 62		Spring 62		Fall 62		Winter 63		Spring 63		Fall 63		Winter 64		Spring 64	
		Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$
Professor (Lecturer)	$12	300	3600	220	2640	220	2640	300	3600	220	2640	220	2640	260	3168	220	2640	220	2640
Section leaders:																			
Senior	2			98	196	98	196	490	980	882	1794	294	588	490	980	490	980	392	784
Graduate Ass't	3.33	294	980	196	653	98	327	294	980	98	327	196	653	196	653				
½-time Instructor	4	1470	5880	490	1960	294	1176	1274	5096					784	3136	392	1568	98	392
Professorq	12													98	1176				
Total			10460		5449		4339		10656		4761		3881		9113		5188		3816

Schedule I-C

(To Support Exhibit 4-15)

__Basic Hours__: in CCTV course

Professors

Lectures	10 hrs.
Recitations	30
Preparation	80
Supervision	80
Examinations	20
	220 hrs.

Plus an added 40 hours for each additional lecture-viewing group.

Section leaders (per section)

Recitation	30 hrs.
Preparation	60
Examinations	8
	98 hrs.

Exhibit 4-16

AFA 211-Principles of Accounting
Instructional Costs by CCTV

	Fall 61	Winter 62	Spring 62	Fall 62	Winter 63	Spring 63	Fall 63	Winter 64	Spring 64
Originating Cost @ $44 per hour	$ 1452	$ 2904	$ 1452	$ 1452	$ 2904	$ 1452	$ 1452	$ 2904	$ 1452
Distribution @ 40¢ per room per hour	48	132	96	60	180	96	60	156	84
Staffing (Schedule II-A)	4143	6892	5123	3816	8199	4389	4012	7807	4535
Occupancy - lecture rooms @ $1.89 per hr.	19	38	19	19	38	19	19	38	19
- recitation @ $.63 per hr.	76	208	151	95	285	151	95	246	132
Special effects: talkback phones (Shared with AFA 210)	95	255	191	95	255	191	127	255	191
Slides, Graphics (est.)	60	60	60	60	60	60	60	60	60
Slide projector rental									
Other: Secretarial (est.)	80	80	80	80	80	80	80	80	80
Total	$ 5973	$10569	$ 7172	$ 5677	$12001	$ 6388	$ 5905	$11546	$ 5553
Cost per enrollment	$ 40.63	25.59	25.34	41.44	23.39	23.83	34.53	25.21	25.11
Cost per student credit hour	$ 13.54	8.53	8.45	13.81	7.79	7.94	11.51	8.40	8.37

Schedule II-A

"Supporting Data for Exhibit 4-16"

	Fall 61	Winter 62	Spring 62	Fall 62	Winter 63	Spring 63	Fall 63	Winter 64	Spring 64
Enrollment	147	413	283	137	513	268	178	458	261
No. lecture sections	1	2	1	1	2	1	1	2	1
No. recitation sections	4	11	8	5	15	8	5	13	7
Hours non-TV lecture	10	20	10	10	20	10	10	20	10
Hours CCTV	30	60	30	30	60	30	30	60	30
Staffing, recitation sections:									
Seniors		3	3		4	7	3	2	4
Graduate Assistants	1		1	2	1	1		1	1
½-time Instructor	3	8	4	3	10		2	10	2
Professor									

Schedule II-B

Staffing Data For Exhibit 4-16

	Rate per hour	Fall 61		Winter 62		Spring 62		Fall 62		Winter 63		Spring 63		Fall 63		Winter 64		Spring 64	
		Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$	Hours	$
Professor (lecturer)	$12	220	2640	260	3168	220	2640	220	2640	260	3168	220	2640	220	2640	260	3168	220	2640
Section leaders:																			
Senior	2			294	588	294	588			392	784	686	1372	294	588	196	392	392	784
Graduate Ass't	3.33	98	327			98	327			98	327	98	327			98	327	98	327
½-time Instructor	4	294	1176	784	3136	392	1568	294	1176	980	3920			196	784	980	3920	196	784
Professor	12																		
Total			4143		6892		5123		3816		8199		4339		4012		7807		4535

FIGURE 4-B

AFA 210-211, PRINCIPLES OF ACCOUNTING TOTAL INSTRUCTIONAL COSTS FOR CCTV COURSE

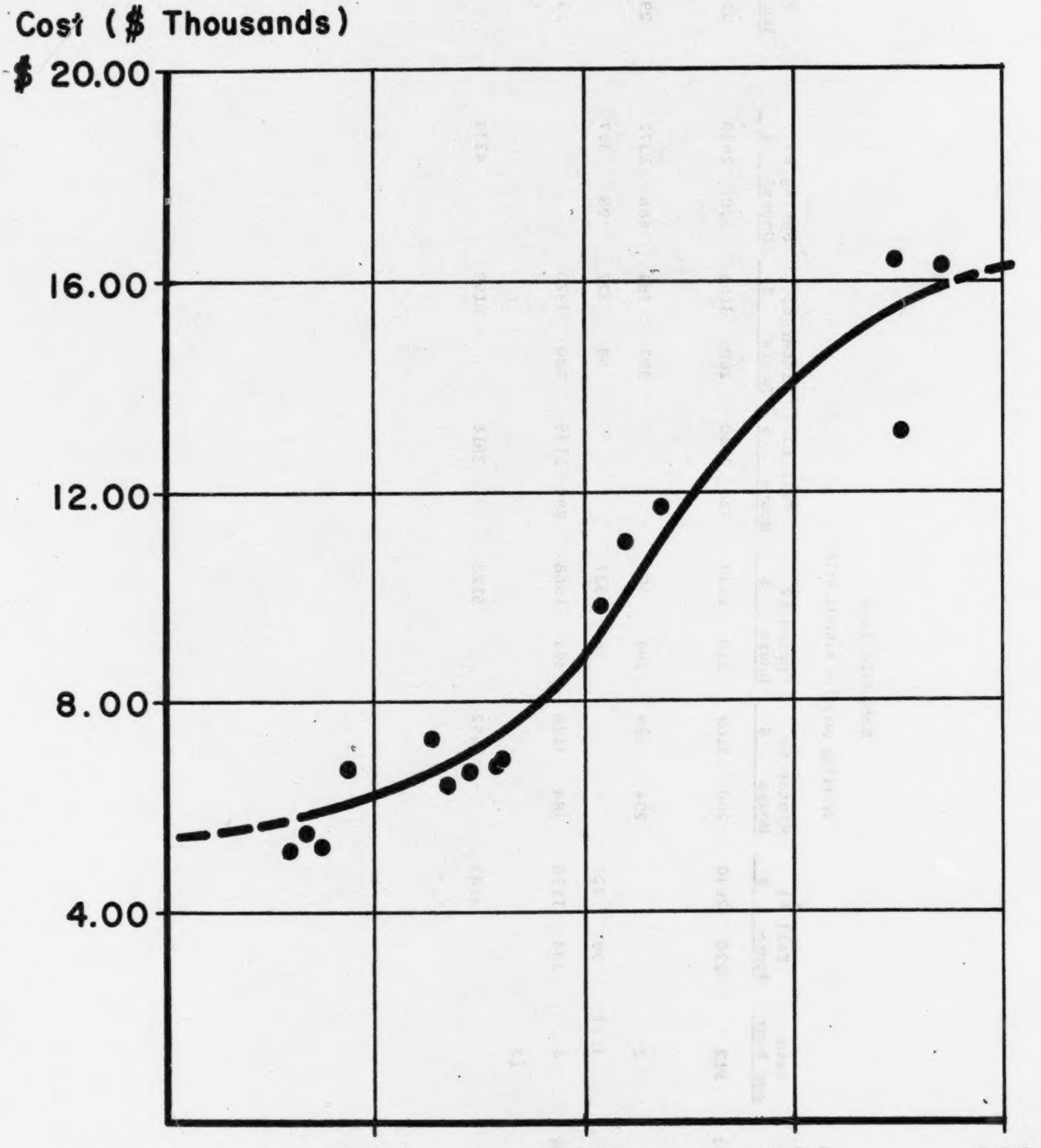
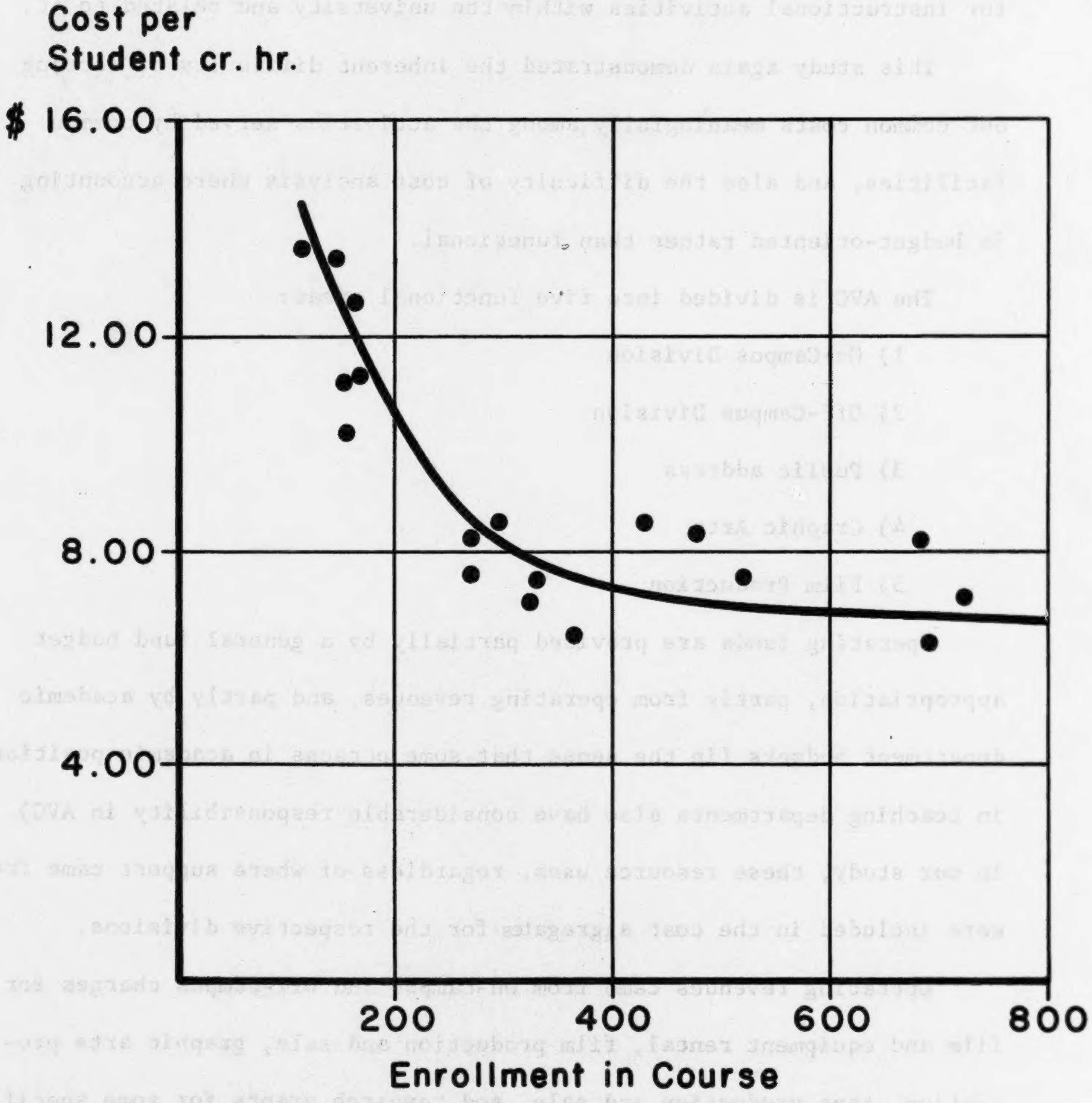


FIGURE 4-C

AFA 210-211, PRINCIPLES OF ACCOUNTING UNIT INSTRUCTIONAL COST FOR CCTV COURSE



Costs of Providing a Media Service

In an attempt to identify the costs of providing each of the many services connected with the use of media in instruction, the ISD project staff made an extensive study of the operating costs of an actual media services establishment. The Audio-Visual Center of Michigan State University performs a wide range of media-associated services for instructional activities within the university and related to it.

This study again demonstrated the inherent difficulty of sorting out common costs meaningfully among the activities served by common facilities, and also the difficulty of cost analysis where accounting is budget-oriented rather than functional.

The AVC is divided into five functional areas:

1) On-Campus Division
2) Off-Campus Division
3) Public address
4) Graphic Arts
5) Film Production

Operating funds are provided partially by a general fund budget appropriation, partly from operating revenues, and partly by academic department budgets (in the sense that some persons in academic positions in teaching departments also have considerable responsibility in AVC). In our study, these resource uses, regardless of where support came from, were included in the cost aggregates for the respective divisions.

Operating revenues came from on-campus and off-campus charges for film and equipment rental, film production and sale, graphic arts production, tape production and sale, and research grants for some specific projects.

Certain expenditures are chargeable to the general fund appropriation budget, including some administrative positions, fractional faculty appointments, equipment and some film library purchases. All other expenditures are made from the operating revenues (a "revolving account"). These include non-faculty salaries, raw materials, film replacements, and supplies.

Among the assumptions made are that equipment is amortizable as follows: delivery vans, 4 years; filing cabinets, 15 years; all other equipment, 10 years.

Average useful life for the 6400 films carried in stock is 5 years.

Among the complicating factors for cost assignment to courses or departments is that a considerable amount of the equipment is permanently installed in classrooms for the use of multiple departments. For example, 47 classrooms are equipped with overhead projectors and there are permanent screens built in to many classrooms. A central pool of record players, slide projectors, tape recorders, overhead and opaque projectors, and movie projectors, is maintained and can be requisitioned by departments. The Public Address division provides maintenance for 11 permanent PA systems in large classrooms and sets up audio equipment for meetings, special affairs, etc.

Basic data for the five divisions is given in Exhibit 4-17 and operating cost data is given in Exhibit 4-18.

It is our conclusion that it is literally impossible to establish accurate costs for each of the many services provided by On-Campus, Off-Campus, or Public Address divisions. The combinations of usages of their services are endless. In most cases, the time spent by a technician, engineer, or repairman on some unit of equipment or on a special assignment is measurable; to this extent the costs related to that job are identifiable. But a substantial portion of costs are incurred not in performing specific services, but in being ready to perform a multitude of greater or lesser services.

It might be possible--and worth trying--to establish typical issuance (order-filling) costs by detailed time study for rental orders processed, to develop average handling times for issuance and related clerical costs. Also, detailed operating life studies on various equipments would provide bases for amortization of original cost, by type of equipment. But unless such data were to be used for (a) charging for services or (b) control of activities, the work of getting the data would be a futile exercise.

Exhibit 4-17

OPERATING DATA, AUDIO-VISUAL CENTER

	On-Campus	Off-Campus	Public Address	Graphic Arts	Film Production
Purposes	Rentals (Film & Eq.), Maint.	Rentals (Film & Eq.), Maint.	Rentals (Audio), Maint.	Slides Posters Transparency, etc.	Films, Composites
Staffing	4 full-time, student labor as needed Film Library: 5 full-time	2 full-time, student labor as needed	5 full-time, some student labor	8 full-time, some student labor	5 full-time, little student labor
Equipment	6400 prints 68 slide projectors 20 record players 60 16 mm projectors 80 tape recorders 20 overhead projectors 3 micro projectors 20 opaque projectors 30 screens		11 installed PA systems variable portable systems	---	---
Annual practical capacity	Expandable with on-call student labor			16,200 hours	9,225 hours
Student labor used, 1963-64	400 hrs. per week	165 hrs. per week	120 hrs. per week	40 hrs. per week	5 hrs. per week

Exhibit 4-18

OPERATING COST DATA, AUDIO-VISUAL CENTER
1963-64 FISCAL YEAR

	On-Campus	Off-Campus	Public Address	Graphic Arts	Film Production
Labor	$ 58,149	$ 41,949	$ 23,254	$ 58,624	$ 41,539
Telephone	2,045	1,544	195	198	199
Transportation	2,556	5,533	452	553	968
Film & Eq. Rental Charges	10,057	12,784	---	---	1,238
Equipment and Facility repairs	3,050	---	4,741	508	701
Postage & Supplies	6,214	3,341	5,039	9,376	1,101
Depreciation of Eq.	12,013	---	2,319	2,469	4,138
Depreciation of Film Library	64,000	64,000	---	---	---
Outside Processing	---	---	---	3,960	12,783
Materials--Film & Slides	---	---	---	---	6,375
Total Resource Uses	$158,084	$129,151	$ 36,000	$ 75,688	$ 69,042
Hours of capacity (manpower)	variable[a]	variable[a]	variable[a]	16,200	9,225
Average hourly oper. cost[b]	---	---	---	$ 3.85	$ 5.41
Billing rate, per hour for labor	$ 1.25	N/A	$ 3.50	$ 3.50	$ 3.50

a Expandable, with use of student labor, on-call basis.

b Excluding outside processing charges and special materials.

Concurrent costing of experimental media uses

Two courses in different subject matter areas at MSU were reorganized in 1964-65, following the outlines of the Instructional Systems Development model developed by the media applications study staff, as part of the current project. Concurrent with course reconstruction, an attempt was made to measure the amount of resources used in the effort. It was not possible to obtain a clear-cut separation of developmental and operating costs because the two stages overlapped. Section VI of the project report contains a discussion of the course development effort, associated costs, and conclusions drawn about trying to cost out course developments.

This experience confirms our observation made in the Accounting-by-CCTV report above, that faculty time is the largest single cost element entering into course development and course operation. It is also the most difficult to obtain detailed, reliable information about. Faculty people are not accustomed to time reporting; it has never been a part of academic discipline. Attitudes toward time-keeping, even for study purposes, vary widely among academic persuasions. Attitudes could easily be the insurmountable obstacle to detailed educational cost analysis.

One interesting by-product of detailed study of faculty time usage for this project is a confirmation of what most professors already know: that the professorial work-week is considerably in excess of the industrial 40 hours. A second discovery, which professors also know but which now has empirical confirmation, is that professors spend only 40 to 70% of their time in activities related to instruction. The rest is in administration, recruitment, editing, public relations activities, personal study, research and writing, and assistance to institutions of various kinds.

Exhibit 4-19 shows the distribution of three professors' time for two quarters. Two of the professors were connected with the current project, the other not. All kept detailed time logs. The two (associate) professors spent 62% and 66% of their time on instructional matters, the third professor only 37% of his time on instruction. The remainder went heavily to administration, research and publication, study, and conference activities.

In the project report, we proposed that some major university should undertake a continued large-scale study in detail of faculty time usage, to determine really where this high-priced resource goes, and what tasks could be passed on to lower-cost personnel. To our way of thinking, this kind of data is the largest gap in measurement of costs of university "products."

Exhibit 4-19

ANALYSIS OF PROFESSORIAL TIME USAGE

	Assoc. Prof. A			Assoc. Prof. B			Prof. C
	F	W	Total	F	W	Total	Total
Teaching:							
Other courses	166.0	132.8	298.8	164.5	163.9	328.4	304.0
Project							
Teaching	109.5	124.8	234.3	105.5	115.3	220.8	
Other	42.0	8.2	50.2	24.0	12.6	36.6	
Total	151.5	133.0	284.5	129.5	127.9	257.4	
Counselling	110.0	60.8	170.8	30.0	26.5	56.5	41.5
Committees	20.0	30.4	50.4	39.5	32.1	71.6	71.0
Continuing Educ.		19.8	19.8		28.4	28.4	19.5
Writing, Editing	110.0	39.6	149.6				20.8
Consulting							57.8
Administration				10.0	42.7	52.7	81.5
Correspondence							44.6
Study & Reading				40.0	47.8	87.8	171.8
Personal Research				29.5	32.7	62.2	40.0
Talks		16.4	16.4				70.0
Grad. Stud. Res.				20.0		20.0	
Course Planning	20.0		20.0				
Curric. Dev.		21.0	21.0				
Misc.		78.2	78.2	31.0		31.0	23.0
Total hours	577.5	532.0	1109.5	494.0	502.0	996.0	945.5
Annual (3 Qtrs.) Salary, Incl. Benefits		$14740			$14740		$17600
Effective Hourly Rate		$8.85			$9.86		$12.41
Portion of time devoted to:							
Instruction		62%			66%		37%
Administration, committees		4.5%			12.5%		16%
Research, publication, and consulting		13%			6%		19%
Other Public Rel.		3%			3%		9%
Own Study		--			9%		18%

V

THE COST ALLOCATION PROPOSAL

One of the Project requirements was to suggest ways of cost allocation within a university, so that appropriate amounts of supporting facility costs can be attached to instructional efforts. In Chapter III we showed a scheme which has had decades of use in industry for apportioning service department costs to production departments. We have a parallel situation in higher education, where there are a large number of service departments existing only to facilitate the work of instructional departments and research units. We show first how the traditional procedure for allocation would be applied, and then we suggest a more complex model to reflect reciprocal service relationships among the departments.

Cost Allocation Procedure

Costs appear at all jurisdictional levels, and in several hundred loci (jurisdictional units, cost centers). For purposes of getting appropriate pieces of cost from these initial points of incurrence to the places where instructional (or other) jobs are done, we provide allocation procedures. Our interest at this point is in getting the portions of costs which pertain to instruction channeled into course categories, as distinguished from those costs which are for non-academic or non-instructional activities.

Let A identify costs incurred at University level, B those incurred at College level, C at Departmental level, D those directly associated with specific courses, and F those which are non-instructional.

Type A costs initially reside in service centers which provide services throughout the institution, mostly for colleges and departments.

Type B costs initially reside in colleges, each of which provides services to departments and to other activities within its structure.

Type C costs initially reside in departments, each of which provides services to courses and to other activities within its structure.

Type D costs initially reside in courses.

Type F costs initially reside in non-academic functions.

If we use B, C, D, F as subscripts to represent the destination levels of type A costs when allocated, we find the allocation process to be: $A \rightarrow A_B + A_C + A_D + A_F$, meaning that the service center costs are allocated to all other levels on some allocation basis (or bases).

In this way, all costs are allocated:

$$A \rightarrow A_B + A_C + A_D + A_F$$

$$A_B + B \rightarrow B_C + B_C + B_F$$

$$A_C + B_C + C \rightarrow C_D + C_F$$

$$A_D + B_D + C_D + D = \text{All instructional costs}$$

$$A_F + B_F + C_F + F = \text{All non-academic costs}$$

After the allocation process is completed, then, all costs rest either in courses $D_{1...n}$ or in non-instructional functions at all three levels of jurisdiction. Thus all costs lie in $D_{1...n}$ plus $F_{1...n}$.

The schematic Figure 4-D shows the logical diagram for instructional cost allocations, portraying the process described above. Exhibit 5-1 shows a worksheet for making the allocations described above. It can be seen that the allocation process becomes very laborious for an institution with very many departments and courses. Although Exhibit 5-1 is for a very small establishment, the working paper calls for 26 columns and 20 lines. This schedule is merely a spread sheet for the amounts allocated. Calculation of allocation bases would precede the filling in of

FIGURE 4-D: LOGICAL DIAGRAM FOR INSTRUCTIONAL COST ALLOCATIONS

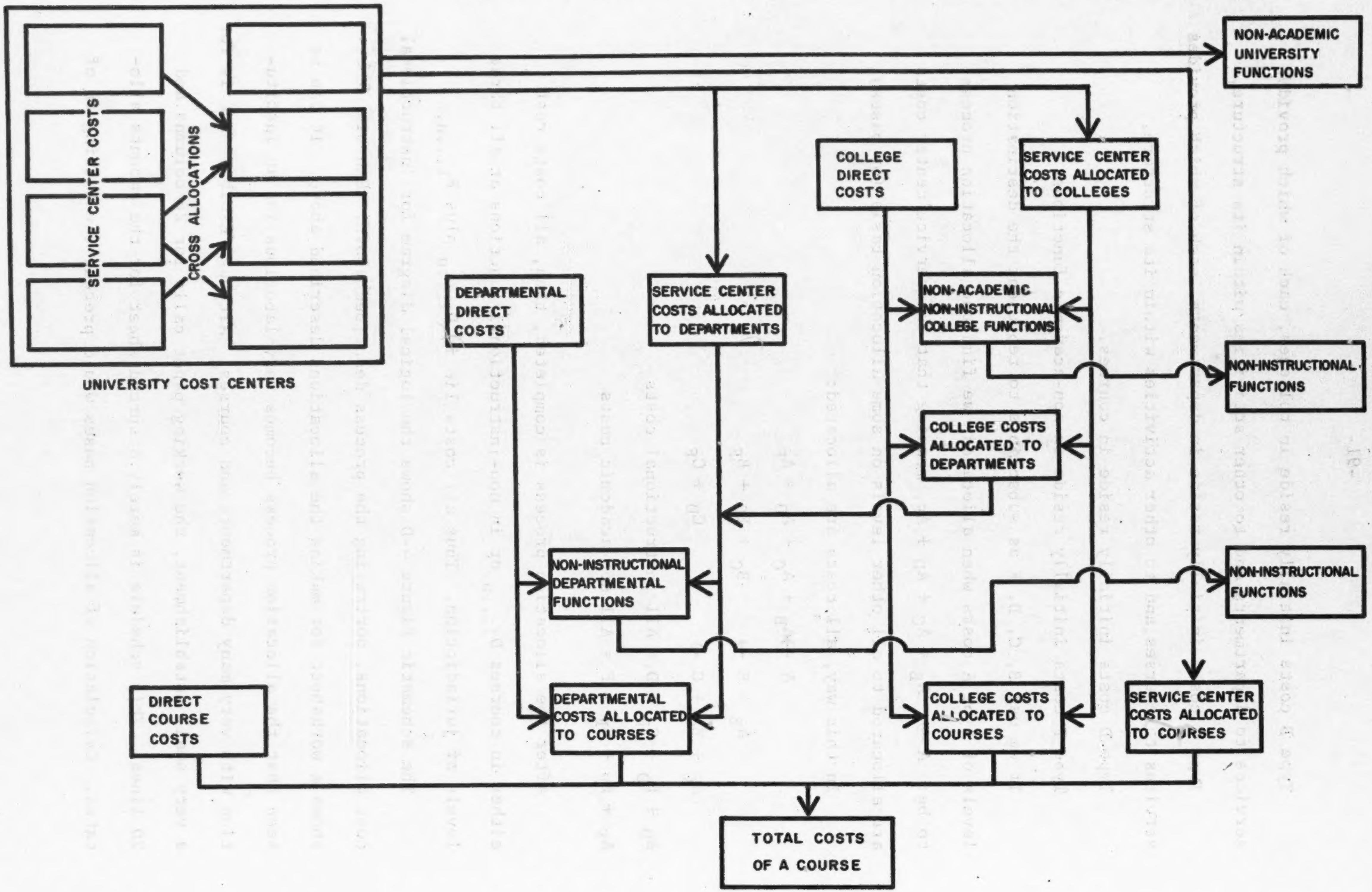

SERVICE CENTER COSTS
CROSS ALLOCATIONS
UNIVERSITY COST CENTERS
NON-ACADEMIC UNIVERSITY FUNCTIONS
COLLEGE DIRECT COSTS
SERVICE CENTER COSTS ALLOCATED TO COLLEGES
DEPARTMENTAL DIRECT COSTS
SERVICE CENTER COSTS ALLOCATED TO DEPARTMENTS
NON-ACADEMIC NON-INSTRUCTIONAL COLLEGE FUNCTIONS
NON-INSTRUCTIONAL FUNCTIONS
COLLEGE COSTS ALLOCATED TO DEPARTMENTS
NON-INSTRUCTIONAL DEPARTMENTAL FUNCTIONS
NON-INSTRUCTIONAL FUNCTIONS
DIRECT COURSE COSTS
DEPARTMENTAL COSTS ALLOCATED TO COURSES
COLLEGE COSTS ALLOCATED TO COURSES
SERVICE CENTER COSTS ALLOCATED TO COURSES
TOTAL COSTS OF A COURSE

Exhibit 5-1

SUGGESTED COST ALLOCATION SCHEDULE*

		College			Departments						Courses												Other Functions				
		B_1	B_2	B_3	C_1	C_2	C_3	C_4	C_5	C_6	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_{10}	D_{11}	D_{12}	F_1	F_2	F_3	F_4	F_5
Direct Costs		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Service Center Costs	A_1		x	x	x	x		x		x	x		x			x					x					x	x
	A_2	x	x			x	x	x				x		x	x								x		x		x
	A_3		x	x		x		x	x		x			x	x								x		x		x
	A_4	x	x	x	x	x		x	x		x								x			x			x	x	x
Totals		x	x	x																							
College Costs	B_1	x			x	x					x	x	x		x											x	x
	B_2		x				x	x					x	x		x	x	x							x		x
	B_3			x					x	x				x					x	x	x	x			x	x	
Totals					x	x	x	x	x	x																	
Departmental costs	C_1				x						x	x		x											x		x
	C_2					x							x	x										x			x
	C_3						x								x	x					x					x	x
	C_4							x									x	x					x				x
	C_5								x										x	x			x				x
	C_6									x					x						x	x					x
Totals											x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Credit hours																											
Cost per Cr. hour																											

*This is for a primitive institution consisting of 4 Service centers, 3 colleges, 6 departments, 12 courses, and 5 non-instructional functions.

this worksheet, and would require extensive gathering of basis data, and computations for pro-rating each of 13 totals as the worksheet is developed.

For a university having two dozen service centers, two or three score departments, and several hundred courses, the allocation procedure is completely unwieldy unless it can be computer programmed. In such a case it would be a relatively simple task once the allocation bases are established and the allocable initial figures obtained.

Reciprocal Costs and Their Allocation

The cost allocation schedule suggested above follows the traditional step-by-step departmental elimination procedure outlined in Chapter III. That method is inadequate in that it ignores the reciprocal nature of service department costs. For example, Payroll receives heat and light from Powerhouse, and Powerhouse is served by Payroll. Stores and Powerhouse, Motor Pool and Purchasing, Laundry and Building and Grounds, are examples of pairs of service departments which serve each other. All such reciprocal relationships could be described in a display as follows:

Departments providing services	Departments Receiving Services				
	A	B	D	E	H
A	_	X	X	_	X
B	X	_	_	X	X
C	X	X	X	X	_
D	X	X	_	_	_
E	X	--	X	_	X

This can be read as follows:

A provides services to B, D, and H.
A receives services from B, C, D, and E.
etc., etc.

The net cost of each department's services equals its own direct costs plus the allocated costs of services it receives from others, less the values of the services it renders to others.

The easiest way to describe this situation in generalized form, is in a table (Exhibit 5-2) using terms defined as follows:

X_1, X_2, X_3, etc., net cost for each department after the allocation process is finished.

x_{11}, x_{22}, x_{33}, etc., each department's measured cost before the allocation process.

x_{12}, x_{13}, x_{14}, etc., the first department's allocation to others.

x_{21}, x_{31}, x_{41}, etc., the first department's allocation from others.

The entire set of relationships, then, can be described in a table, (Exhibit 5-2) as a system of simultaneous equations which express the effects of reciprocal arrangements. Plugging the necessary data into the system of equations and solving the resulting matrix for the unknowns will give the after-allocation costs.

Exhibit 5-2

Allocation Matrix for Service Costs

$$X_1 = + x_{11} - x_{12} - x_{13} - x_{14} - x_{15} + x_{21} + x_{31} + x_{41} + x_{51}$$

$$X_2 = - x_{21} + x_{22} - x_{23} - x_{24} - x_{25} + x_{12} + x_{32} + x_{42} + x_{52}$$

$$X_3 = - x_{31} - x_{32} + x_{33} - x_{34} - x_{35} + x_{13} + x_{23} + x_{43} + x_{53}$$

$$X_4 = - x_{41} - x_{42} - x_{43} + x_{44} - x_{45} + x_{14} + x_{24} + x_{34} + x_{54}$$

$$X_5 = - x_{51} - x_{52} - x_{53} - x_{54} + x_{55} + x_{15} + x_{25} + x_{35} + x_{45}$$

Solution of systems of linear equations of limited size is possible by procedural row-and-column manipulation (the "Gauss-Jordan complete elimination procedure")* which can be done manually or can be computer programmed. The number of unknowns in the allocation matrix for a typical large university is so great that a computer solution is absolutely necessary.

In order to apply this matrix idea to a cost allocation situation, two pieces of data must be known:

a) recorded costs, in total, for each source department

b) the basis for allocations from each source to each destination, expressed as proportions (percents).

The attached table (Exhibit 5-3) shows a convenient way to construct the cost allocation matrix. All service centers, colleges, departments, institutes, and bureaus are listed at left margin and again as column headings across the top. For each cost center listed at left, check marks are placed in the columns to the right for all units which receive services from that cost center.

The next step is to replace the check marks with proportions (percentages) which represent the relative amounts of service center costs to be allocated to each recipient on the same line. The proportions must always add up to 1.00 across each line. If a department performs no services for other departments, it has only one line entry, a 1.00 in its own line and column intersection. It would have numerous column entries for the services which it receives from other cost centers. This would be the case with most instructional departments, for example.

---

* See A. M. Glicksman's Linear Programming and the Theory of Games (New York: Wiley and Sons, 1963). It shows the row-and-column procedure in an understandable way.

The really big task in cost allocation is to develop proportional relationships for distribution of each one of the cost centers listed at left. There are 18 supporting service units listed in Exhibit 5-3. At a school the size of Michigan State University, there are over a dozen colleges, over 70 departments, and about 35 Institutes and Bureaus. The matrix incorporating all of these units would contain approximately 150 lines and the same number of columns. This means that there is a system of about 150 simultaneous equations to solve for unknowns, the unknowns being the post-allocation cost totals for each of the cost centers.

Solution by matrix inversion is a pedestrian task for a modern large-scale computer. Computer centers have standard matrix inversion routines for such problems. We would not want to make the problem seem trivial, however. The act of establishing inter-center relationships could occupy many man-years and produce endless debate on the most appropriate (i.e., least unsatisfactory) basis for allocating each service center to its service recipients.

After the matrix manipulation, each production department's (i.e., academic department or research institute) post-allocation cost total has been obtained. We still have a long way to go, however. The departmental total costs must then be prorated among the courses and/or activities engaged in. Some judgment must be formed as to proportions of departmental efforts and resources going into research and/or image creation activities; the remainder must go into instruction. But this is still not final; a further breakdown into courses and degrees produced will provide final course and degree costs. The reader can see that such a determination is possible in an arithmetic sense, but that the factors

Exhibit 5-3

Suggested Cost Allocation Matrix

Users of Services Sources of Services	Accounting	Admissions	Agr. Econ.	Agr. Eng.	Anatomy	Biology	Business	--	--	Data Proc.	Dormitories	--	--	History	Horticulture	Hotel	--	--	Police	--	Institute	Center for--
Accounting		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Admissions			X	X	X	X								X	X						X	
Agr. Econ.									X													X
Agr. Eng.									X												X	
Anatomy																	X	X				
--																						
--																						
--																						
Chemistry						X																
Comptroller	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Data Processing	X	X					X				X					X			X			
Dormitories																	X	X				
Food Service											X					X					X	X
Forestry																						
History																						
--																						
--																						
Maintenance																						
Motor Pool				X			X				X	X			X	X	X		X			X
--																						
--																						
Registrar		X	X	X	X		X							X	X							
--																						
Zoology						X											X	X				
Institute for	X						X				X		X			X						
Center for	X						X				X		X									

and all additional departments, units, and segments of which the university is composed
(possibly 200 or more cost centers)

which affect the relative magnitude of final unit costs for various courses are judgmental, at best.

As we have pointed out previously the purposes of costing are (a) planning (b) cost control (c) inventory valuation, and (d) product pricing. Since colleges do not produce stock for inventory valuation, we can dismiss (c) as being inapplicable. Perhaps, in a gross way, unit cost figures resulting from the allocation process might be useful in planning; contemplation of expected growth in a given subject area could lead one back up the allocation ladder to measurement of possible effect on service centers' loads, costs, and budgetary requirements. Unit cost data based on allocation is practically valueless for cost control, because it does not coincide with the locus of responsibility for cost incurrence. Finally, we think some unit cost usefulness could be found in furnishing a basis for differentiating prices (tuition charges) among various subject matter fields, and even for different courses within a subject matter field.

It does not necessarily follow that tuition rates would be adjusted for course cost differences. This is a matter for administrative decision. But administrators would have an indicator of the "gain" or the purposefully undertaken loss in certain study areas where tuition rates charged vary substantially from computed costs.

A cost allocation matrix of the magnitude and complexity of that suggested here requires data collection and analysis work far beyond the resources available for the current study project. It is an approach to instructional cost determination which is worthy of investigation on a large-scale long-term basis.

Coding for course costs

To accomplish an allocation like that suggested, an orderly way to identify functions (courses of instruction, research programs, non-instructional activities, etc.) is needed. This identification can be achieved by use of a straight-forward numeric code for cost destinations. The code normally will not coincide precisely with the budget account numbers, which are arranged by jurisdiction and object of expenditure. (By "object of expenditure" we mean personal services, fuel, postage, supplies, etc.)

There will be some cases where the locus of expense recognition may coincide with the jurisdiction. In such cases the initial purchase of supplies or labor is identifiable directly with a certain course or project within a department. For example, student labor hired to proctor viewing rooms in the closed-circuit Accounting course is chargeable directly to the Accounting Department's Student Labor account, which has a budgetary account number and a code to represent the object of expenditure, personal services. Under functional accounting, it would also be coded with an expense account number representing the course itself. We see, then, that although the locus is the same (Department), the budget-account placement is not necessarily the same as the expense-account placement of the charge.

Under the allocation scheme proposed, the most prevalent use of the functional account classifications (i.e., by course) would be for final destination of allocated charges. For example, coal purchases are chargeable initially to a Powerhouse budgetary operating account and are coded as object of expenditure Fuel. Under budgetary accounting, no further disposition is made of this cost item, except to the extent that charges are transferred to revenue-producing activities (dormitories) for power and steam use. These transfers constitute, in effect, sales of steam and electricity. They are not cost allocations. Under functional accounting, total powerhouse costs would be apportioned to electric power and steam production. Steam cost is then allocated to the several buildings, and becomes a part of occupancy cost for each building. Occupancy cost for the structure is then allocated to the colleges, departments, or courses housed in the structure, as cost centers. The Instructional portion of the total cost of the College housed in the building is then apportioned to departments and courses. The instructional part of the Departmental total cost is allocated to courses. Thus a portion of cost of coal eventually comes to rest in costs of specific courses, although its budget placement was in the Power Plant accounts.

A feasible numerical code for cost destinations is

First 2 digits represent service center	xx
Next 2 digits represent college	xx
Next 2 digits represent department	xx
Next 2 digits represent course or program	xx

For example, if university mail room is Cost Center #7, a mail-room expense chargeable to a certain project in a certain department in a certain college would be:

07-xx-xx-xxx.

A cost allocation for department #18 to a certain one of its courses, number 014, for example, might be

xx-xx-18-014.

A block of course numbers (900's, for example) would be needed in the last 3 digits to indicate non-instructional functions or programs such as contract research programs or public relations activities which cut across jurisdictional lines.

For example, a college-wide non-instructional functional cost (a

Dean's trip to a meeting of Deans, for illustration) incurred in college #6 could be identified as

xx-06-xx-904.

This coding scheme is designed to address charges to where we want them distributed. They would not replace source (budget) account codes as presently used. This suggested scheme would be used for gathering the functional expense data which is relevant to getting some kind of job performed, and would frequently not coincide with budget account charges.

A specific set of numerical account codes is not developed here; this is best developed in individual institutions to fit their organizational and functional expense information needs.

This scheme would demand a much more careful identification at user level of item usages. For example, periodically a department chairman would have to identify the functional purposes of long distance calls made by his department, according to some uniform classification. He might identify them as related to faculty recruitment (administration), faculty appearances (public relations), scholarships (administration), appointments to gather research data (research), textbook selection (instruction), and so on. Better yet would be a recording of the functional purpose of each call at the time it is made. He also would provide at periodic intervals at least an estimate of the final functional uses of supplies, travel, student wages, etc.

Where a departmental faculty member renders advice to another agency of the university, his report would show the destination code for the time used. In the subsequent periodical grand cost allocation manipulation, a piece of servicing department costs would be assigned to the department which used the member's services (An alternative would be to make an interdepartmental transfer at the time of rendering of service, at some arbitrary "selling" price for his services).

For detailed cost apportionment within departments, it would be necessary for users of time (i.e., faculty members) to identify how the most costly university resource--their time--is used. This would mean daily, detailed time reporting according to some uniform pre-established expense classification. The classification would very likely include codes for instruction, counselling, recruitment, placement, faculty research, student research, public relations, and so on.

Such detailed identification would require an intense educational effort over a prolonged period, to overcome resistance, inertia, and misunderstanding. It is questionable whether faculty members and administrators in many disciplines could be driven, coaxed, cajoled, or otherwise persuaded that a valid requirement exists for such detailed attention to the use made of time and things and services. Nor is it likely that university administrators would make the issuance of funds contingent upon compliance with expense account coding requirements.

However, any complete, comprehensive, detailed knowledge of university functional costs requires this careful attention to accounting detail. It is only attainable if top administrators actually want costing information badly enough to risk the determined opposition of non-compliant faculty members, and if the case for detailed costing data can be made strong enough to convince a majority of deans and department heads.

VI

SUMMARY AND CONCLUSIONS

Evaluation of instructional costs in a large modern university is a baffling exercise in splitting joint costs and measuring intangible, invisible joint products, in a type of establishment where established accounting structures and employee personalities are not geared to cost accounting. Almost every university resource is used jointly to create the multiple products of degrees, research and image creation and each product draws upon multiple sources in its creation.

The pressures of increasing enrollments without corresponding increases in faculty resources, coupled with the availability of new media techniques, have led universities to seek innovations in instructional methods. The companion report to this study, "A Procedural and Cost Analysis Study of Media in Instructional Systems Development" concerns the nature of these innovations and reports briefly on their history and costs at Michigan State University.

In the present volume, we have reported in more detail on cost experience in closed circuit television. We have attempted to relate the instructional cost identification problem to the broader world of industrial cost accounting, borrowing ideas therefrom which might be useful in instructional costing. We have also identified the environmental hindrances to effective instructional analysis: (a) accounting systems and procedures designed for assuring budgetary compliance rather than for measuring performance or functional costs, and (b) an environment in which the detailed reporting of resource usage information necessary for costing is quite foreign to employees (faculty) and which would probably be resisted vigorously if sought.

A university is a high-fixed-cost operation. To attach fixed costs to units of "product", cost allocation is unavoidable. No really satisfactory bases of allocation exist. Two approximately satisfactory allocations approaches are shown: the traditional service center elimination procedure, and a proposed cost allocation matrix which reflects all the reciprocal inter-departmental services provided with a university.

The matrix allocation procedure, as far as we know, is untried in university cost accounting. It was too large an effort to undertake in the current project, involving, in a large school, up to 150 simultaneous equations in the model. The preparatory work would be formidable, the matrix solution via computer not difficult. Hopefully, its application would furnish bases for recognizing cost differences in different subject matter areas, with possible pricing implications.

I. Cost Analysis in Higher Education--General

Benson, Charles S. The Economics of Public Education. New York: Houghton Mifflin, 1961, pp. 580.

School finance is treated as a sub-area of the field of public finance. The problems of financial support and management of public education are discussed within the analytical framework of economics. Two main themes are developed: how a decentralized system of public education can command the resources necessary to perform its tasks, and how the available resources can be utilized effectively in the process of instruction.

Benson, Charles S. Perspectives on the Economics of Education. New York: Houghton Mifflin, 1963, pp. 477.

The book is a collection of 52 readings over the whole range of school finance. Items pertinent to cost analysis in higher education are: Performance Budgeting, Electronic Data Processing and Administrative Organization, and The Capital Budget.

Cain, J. Harvey. "How Unit Cost Accounting Can Serve College Field." College and University Business, 32, March 1962, 63-65.

Discusses the need for unit cost studies and purposes they serve. Concludes that there are good reasons for making these studies even though it is difficult to do so and in spite of the danger they may be misused. One reason given is that people responsible for furnishing the money for higher education are demanding this kind of information. Another is that such studies are needed for long-range budgetary projections.

California and Western Conference Cost and Statistical Study: Reproductions of Original Forms and Instructions. Berkeley: University of California, n.d. 129 pp.

Contains copies of the summary statement on purpose and procedure for the study, the summary list of standard classifications, original forms, and detailed instructions for these forms.

Chambers, M. M. Financing Higher Education. Washington: The Center for Applied Research in Education, Inc., 1963, pp. 84-91.

A general discussion of unit costs of instruction, their limitations, and uses. Says that "if used with the greatest of caution and if their shortcomings are carefully explained, these concepts may be a means of providing clues to comparative costs among classes, departments, and institutions."

Doi, James I. "The Analysis of Class Size, Teaching Load and Instructional Salary Costs." In Axt, Richard G. and Sprague, Hall T. (eds.), College Self Study: Lectures on Institutional Research. Boulder Colorado: Western Interstate Commission for Higher Education, 1960, pp. 183-197, A-1 to A-28.

> Discusses the purposes served by studies of faculty work load and instructional costs. Describes two types of studies on faculty work load--those that deal with "total service load" and those confined to "teaching load." Also describes two types of instructional cost studies--those limited to teaching or instructional salary costs and those that include other expenditures directly related to the function of instruction such as supplies and services. Devotes most of the article to a discussion of terms and techniques used in a study of teaching loads and instructional salary costs. Presents forms, instructions, and illustrative tabulations for studies of this kind in Appendix A on pages A-1 to A-28.

Eells, Walter Crosby and Hollis, Ernest V. Administration of Higher Education: An Annotated Bibliography. U. S. Office of Education, Bulletin 1960, No. 7, OE-53002. Washington: U. S. Government Printing Office, 1960. pp. 353-354.

> Includes 10 annotations under the heading "Cost and Use Analysis." References to other annotations are also given.

Evans, John M. and Hicks, John W. An Approach to Higher Educational Cost Analysis. Lafayette, Indiana: Purdue University, Division of Educational Reference, n. d. 30 pp.

> The authors describe the method used by the four publicly supported institutions of higher learning in Indiana in preparing data showing cost per student by level of instruction. The data are used to justify legislative requests. They then discuss the objectives of cost studies, factors affecting instructional costs, kinds of data required for cost analysis, and basic procedures, used in the process. Twelve conclusions drawn from the authors' experiences are listed.

Florida Cost Study Committee and the Office of the State Board of Control. A Manual for Analyzing University Expenditures by Function. Revised 1960-61. Tallahassee: State Board of Control, n.d. 66 pp.

> A manual designed to produce information relating to the cost of performing services in the State University System of Florida. Includes a description of each of three categories of services--resident instruction, organized research, and extension--which are recognized as the chief purposes of the universities. Presents forms and instructions (a) for allocating expenditures

from the categories in which financial records are kept to each of the service categories, (b) for computing unit costs of instruction and certain other services, (c) for obtaining data on factors related to instructional costs, and (d) for reporting information to the Office of the State Board of Control, Procedures for computing unit costs of instruction include allocation of overhead expenditures at the department, college, and university level. Two instructional units are used in the computations, the "student semester hour of instruction" and the "full-time equivalent student." Data are accumulated by department, by level, and by type of expenditure.

Harris, Seymour E. Higher Education: Resources and Finance. New York: McGraw-Hill Book Company, Inc., 1962, pp. 501-633.

Eleven chapters under the general heading of "Costs and Economics." Chapter 42 stresses the need for cost studies in higher education, their purposes, and limitations. Chapter 43 presents examples from several cost studies to show how information of this kind can be useful. Chapter 44 discusses possible economies resulting from increases in class size, decreases in the number of courses, and experiments in instructional methods. Chapters 45 to 52 deal with related topics such as the attitude of college and university officials toward economical management of their institutions, the need for increased productivity in higher education, optimum size of an institution, planning, cooperation and coordination, plant location and utilization, and recent developments involving the use of television for instructional purposes.

Hereford, Karl T. The Production of Secondary School Personnel: Projected Costs. East Lansing, Mich.: Institute for Educational Research and Improvement, 1965, 22 pp.

Outlines an educational program and presents a schedule of personnel and other costs required to produce 1,000 secondary school teachers annually in Costa Rica, El Salvador, Honduras, Guatemala, and Nicaragua.

Hicks, John W. "Making the Best of Limited Resources." College and University Business, 23, December 1957, 21-23.

Says the purpose of the article is "to lay out a conceptual framework with respect to institutional costs, studies of these costs, and the uses of the results of such studies." Starts with the idea that what a college or university actually produces is an environment for learning, i.e., that it does not "produce" or "process" students. Discusses various factors required for producing such an environment (professors, books, classrooms, etc.) as well as certain conclusions about methods of reducing the cost of these factors. Describes two types of research on this subject, "status quo" research and "developmental" research. Status quo research is defined as fact-finding "concerning the factors involved in providing the environment being created at any given time." Developmental research is "critical evaluation of the educational effectiveness of a given environment and the development of new environments that may be more effective or less costly." Discusses who within institutions of higher education should carry out these two types of research and the relative usefulness of data obtained from them, particularly in inter-institutional studies.

Higgins, E. E. and Holbrook, A. J., "How Much Does College Classroom Space Really Cost?", *Higher Education*, (20, 9), June 1964, pp. 8-10.

Holy, T. C.; McConnell, T. R.; and Semans, H. H. "California Studies Its Needs and Resources in Higher Education." *The Educational Record*, 36, October 1955, 291-303.

A summary of a report prepared for the Liaison Committee of the Regents of the University of California and the State Department of Education and published under the title *A Restudy of the Needs of California in Higher Education*. The following topics are discussed: (1) the potential increase in college and university enrollments in California; (2) the need for diversity among and within institutions of higher education; (3) administration, control, and coordination of the various segments of higher education in California; (4) utilization of physical plants and estimates of future plant needs; (5) analysis of current expenditures for 1953-54; and (6) the ability of California to support public higher education. With regard to the fifth topic, it is pointed out that "unit expenditures for instruction, expressed in terms of cost per student credit hour, were computed for each institution and reported for lower-division, upper-division, and graduate levels." The reader is referred to the full published report for details.

Hubbard, Robert E. "An Approach to Institutional Cost Analysis." *Journal of Experimental Education*, 31, December 1962, 109-113.

Describes procedures used at Wayne State University to compute direct costs of instruction by department and by student level. Data are based on faculty estimates of the percentage of time devoted to instruction, research, public service, administration, and other activities. Also discusses briefly (1) various kinds of information obtained from computer programs that combine data from faculty service forms, class list summary cards, and faculty payroll records; (2) some fringe benefits of cost analysis; and (3) a sample study concerning the allocation of library costs.

Hull, L. E. "Pitfalls in the Use of Unit-Cost Studies." Journal of Higher Education, 32, October 1961, 371-376.

Discusses the following pitfalls or undesirable characteristics of unit cost studies: (1) data are quantitative and not qualitative in nature; (2) quantitative measures of faculty performance currently utilized are not accurate; (3) use of cost studies may imply that cost is the most important aspect of the educational climate; (4) charging all expenditures back to instruction may distort real instructional costs; (5) nature of cost study data may lead to faculty interpretations, misuses, etc.; and (6) availability of cost study data may lead to abuses resulting from excessive zeal to reduce costs. Concludes that the positive benefits of cost studies far outweigh their disadvantages and that the need is for more refinement in their construction, more understanding of their nature, and more intelligence in their use.

Ikenberry, Stanley. "Instructional Cost and Quality." College and University, 37, Spring 1962, 242-250.

Supports the thesis that attempts to lower instructional costs per student need not result in a corresponding decrease in instructional quality. Describes three variables that determine unit costs of instruction (instructional salaries, average credit hours of teaching per faculty member, and average class size) and states that class size is the crucial variable in trying to reduce costs. Explains three principles related to the psychology of learning and curricular organization that help determine the quality of education programs: (1) that instructional objectives should be clearly stated and operational, (2) that appropriate experiences should be carefully selected to achieve these objectives, and (3) that selected experiences should be organized and integrated. Argues that course proliferation is an obstacle to attainment of quality programs. Concludes that instructional quality can be increased and costs of instruction controlled by a reduction in the number of courses.

Jamrich, John X. "Research Technics in State Surveys." College and University Business, 29, September 1960, 49-52.

Discusses various kinds of analyses generally included in statewide surveys of higher education. Lists the kinds of data required for an analysis of instructional programs and the types of information that can be obtained from them. Describes the procedure devised for a survey of higher education in Michigan, with emphasis on the use of punched cards. One type of information resulting from this procedure is "instructional salary expenditure per student-credit-hour."

Jamrich, John X. "Research Techniques in State Surveys of Higher Education." *College and University*, 35, Winter 1960, 195-203.

Describes briefly various types of analysis included in a typical state or regional survey of higher education. Lists the kinds of data required for an analysis of instructional programs and the kinds of information obtained from them, including instructional salary expenditure per student-credit-hour. Describes the punched-card procedure used for such an analysis in a survey of higher education in Michigan. Mentions some of the problems related to a study of this kind and concludes that there is need for more deliberate co-ordination and co-operation among surveys, for refinement and agreement upon basic measures used, and for compilation of current normative data on such measures.

Jedamus, Paul. *An Analysis of Class Size, Teaching Loads, and Instructional Salary Cost for the Regular Academic Year 1961-62*. Prepared for the Association of State-Supported Institutions of Higher Education in Colorado, November 1963.

Latest in a series of annual reports that began with publication of data for 1955-56. Contains detailed statistics for the eight state-supported institutions of higher education in Colorado showing the scope of course offerings, class size, teaching loads, and instructional salary costs. Two sets of data are presented, one based on credit-hours and the other on contact-hours. Figures are shown by institution, by subject field, and by instructional level. Unit cost data show instructional salary cost per student-credit-hour produced and instructional salary cost per student-contact-hour produced.

Kettler, Raymond W. "The Analysis of Class Size, Teaching Load and Instructional Costs." In Axt, Richard G. and Sprague, Hall T. (eds.). *College Self Study: Lectures on Institutional Research*. Boulder, Colorado: Western Interstate Commission for Higher Education, 1960. pp. 199-212, A-29 to A-74.

Discusses the need for analysis of factors affecting instructional costs, early studies of these factors, and the nature of each factor. Explains the effects of class size and teaching load on instructional costs. Describes some of the forms and procedures used in the California and Western Conference Study to measure *total* faculty work loads and *total* instructional costs. Copies of the forms and detailed instructions are presented in Appendix A on pages A-29 to A-74.

Kettler, R. W. "The Cost of Higher Education." *In Proceedings, The Association of Governing Boards of State Universities and Allied Institutions*, 33rd Annual Meeting, October 18-22, 1955, 55-64.

Includes a brief discussion of the nature of unit cost studies, their limitations, and their possibilities. Then discusses trends in total costs of higher education, past and future.

Knott, Leslie W. "Analyzing the Cost of Collegiate Nursing Education." *College and University Business*, 21, October 1956, 49-53.

Describes a method for determining the costs of basic collegiate nursing education programs which was developed as a result of a joint study sponsored by the National League for Nursing and the U. S. Public Health Service. The study included six colleges and universities as well as a large number of hospitals and other health agencies associated with them. Illustrates and explains procedures for allocating various types of indirect costs. Discusses areas of concern identified by participants in the study. Presents recommendations of the advisory committee with regard to future studies of this kind.

Master Plan Survey Team. *A Master Plan for Higher Education in California, 1960-1975*. Sacramento: California State Department of Education, 1960. pp. 146-175.

Chapter IX, Costs of Higher Education, is based on findings of the Technical Committee on Costs of Higher Education in California, presented in detail in *A Report on the Costs of Higher Education in California, 1960-1975*. Selected data showing actual and projected costs at public institutions of higher education are included, as well as recommendations of the Survey Team.

McConnell, T. R.; Holy, T. C.; and Semans, H. H. *A Restudy of the Needs of California in Higher Education*. Sacramento: California State Department of Education, 1955. pp. 407-460.

Chapter VII contains an analysis of current expenses for educational and general purposes at institutions of higher education in California for the fiscal year 1953-54. Included in the study were the University of California, 11 state colleges, 44 public junior colleges, and 22 participating private institutions. The nature, uses, and limitations of such an analysis are explained. Procedures and results of the study are described. Detailed information is shown in tabular form. Three measures of unit costs were used: expense per student-credit-hour for educational and general purposes, teaching expense per student-credit-hour, and total departmental expense per student-credit-hour.

McNeely, John H. *University Unit Costs*. U. S. Office of Education, Bulletin 1937, No. 21. Washington: U. S. Government Printing Office, 1938. 35 pp.

Presents the results of a study of unit costs of instruction in nine large universities, both public and private, for the fiscal year 1934-35. The study employed the procedures developed by the National Committee on Standard Reports for Institutions of Higher Education and described in *Financial Reports for Colleges* and Universities. The unit of instruction used in the study is the student-credit-hour. Instructional costs include teaching costs and overhead costs. Unit cost figures are computed for each department, school, and college, and for each of three levels of instruction. Basic procedures are explained.

Middlebrook, W. T. "Survey of Unit Costs in State Universities." *Transactions and Proceedings of the National Association of State Universities in the United States of America*, 53, 1955, 79-90.

A brief report indicating the general plan of approach for the California and Western Conference Cost and Statistical Study. Followed by questions and answers.

Miller, James L., Jr. *Inter-Institutional Cost Studies for Michigan: An Appraisal*. Lansing: Michigan Council of State College Presidents, 1961. (Mimeographed) 50 pp.

A study of concepts and procedures involved in making inter-institutional unit cost studies. Includes a discussion of "the Michigan dilemma," the nature and purposes of cost studies in general, characteristics of cost studies in several states, prerequisite conditions for successful cost studies, readiness of Michigan institutions for such studies, major steps required for developing studies in Michigan, and technical and procedural issues related thereto. Bibliography of 42 items.

Millett, John D. *Financing Higher Education in the United States*. The Staff Report of the Commission on Financing Higher Education. New York: Columbia University Press, 1952. pp. 99-202.

Contains five chapters dealing with various aspects of cost analysis in colleges and universities: Cost Trends, Factors in Educational Costs, The Program Analysis of Educational Costs, Administrative Costs, and Special Cost Problems. Much of the discussion is based on summary data showing current operating expenditures of higher education in the U. S. for the years 1930, 1940, and 1950.

Murdock, William J. "Cost Accounting Can Play a Part." College and University Business, 28, February 1960, 34-35.

Says that "at the University of Pennsylvania we have made cost studies for more than 30 years" and that "until we can develop a technic that translates budget proposals into analytical cost data, I see little use for future studies of instructional costs." Discusses briefly several ways in which the distribution of indirect costs may be useful; e.g., in computing maintenance costs of buildings, in determining costs of printing or other service departments, and in determining costs related to restricted funds. Concludes that cost accounting has a place in universities but that the problem is "to keep it in its proper perspective as one, and only one, of the various criteria necessary for informed decision making."

National Committee on Standard Reports for Institutions of Higher Education. Financial Reports for Colleges and Universities. Chicago: University of Chicago Press, 1935. pp. 177-249. (Reprinted under the title Computation of Unit Costs. Washington: American Council on Education, 1955.)

A discussion of the purposes and values of unit cost studies, factors involved in unit cost computations, and two procedures for computing unit costs--a "short" procedure and a "detailed" procedure. The short procedure does not provide for allocation of overhead or other general expenditures, for distribution of faculty salaries on a functional basis, or for computation of costs by levels of instruction. The detailed procedure does. Both procedures call for computation of costs per full-time-student equivalent and per student-credit-hour. Three forms are presented for use in computing unit costs according to the short procedure; forty-eight are shown for the detailed procedure.

National Committee on the Preparation of a Manual on College and University Business Administration. College and University Business Administration. Vol. 1. Washington: American Council on Education, 1952. pp. 120-134, 159-161.

Contains an explanation of reasons for and methods of allocating indirect expenditures in the computation of costs for colleges and universities. Bibliography of 32 items under the heading "Costs."

National Committee on the Preparation of a Manual on College and University Business Administration. College and University Business Administration. Vol. II. Washington: American Council on Education, 1955, pp. 189-190.

A bibliography of 17 items under the heading "Costs," all published during the years 1951 to 1954 inclusive.

Peden, Robert W. "Is There an Educational Industry?" College and University Business, 21, November 1956, 50-51.

Says the two manuals compiled by the National Committee on the Preparation of a Manual on College and University Business Administration are "a milestone of progress" but that "they have not gone far enough." Lists seven concepts for the purpose of promoting further improvements in college administration. One of these is the need for modern cost accounting methods, including the computation of unit costs of instruction.

Pike, Walter L. "What You Can Learn from Unit Costs." College and University Business, 37, July 1964, 39-41.

States that the purpose of the article is "to present a standard cost procedure that can be used by individual instructors for analyzing unit-cost data." Gives a lengthy example to show how standard costs are computed and how differences between standard and actual costs can be analyzed.

Rand, Edson R. "If Unit Cost Calculations Are to Be Valid." College and University Business, 19, August 1955, 25-26.

Discusses briefly three reasons why valid unit cost data are important. Mentions various units that can be used as a basis for computing unit costs, but indicates a preference for the per-capita-student unit. Says methods for computing unit costs have long been established and refers to the 1935 report of the National Committee on Standard Reports for Institutions of Higher Education. Stresses the importance of precision and accuracy in classifying and distributing expenditures and in establishing the number of units for which the cost is to be determined. Gives several reasons why unit costs "seem to be as frequently legerdemain by which administrators fool themselves as they are tools by which better results are obtained."

Russell, John Dale. "Break-Even Points in the Organization of Instructional Programs." College and University Business, 27, August 1959, 25-26.

Says the break-even point for an instructional program in a college or university may be expressed in terms of three different measures: (1) student-credit-hour production per full-time-equivalent member of the instructional staff, (2) instructional salary expenditure per student-credit-hour, and (3) average size of classes weighted according to the number of credits each class carries. Gives examples and mathematical formulas to show how these measures are used in determining break-even points.

Russell, John Dale. "Budgetary Analysis." In Axt, Richard G. and Sprague, Hall T. (eds.). College Self Study: Lectures on Institutional Research. Boulder, Colorado: Western Interstate Commission for Higher Education, 1960, pp. 101-153, 277-278.

A composite of detailed lecture outlines and considerable material from the series of articles by Russell and Doi on "Analysis of Institutional Expenditure" appearing in College and University Business during 1955 and 1956. Discusses (1) major categories of expenditures in colleges and universities as outlined in the standard system of classification, (2) classification of "educational and general" expenditures by function, and (3) four basic techniques for analyzing expenditures in this category. The four techniques involve computation of the percentage distribution of expenditures by function, expenditures per unit of service, expenditures related to certain "programs," and the percentage of increase or decrease in expenditures from some previous period. States that normative data are needed for adequate interpretation of any analysis of institutional expenditures, mentions three types of normative data, and lists several requisites for them. Material taken from the series of articles in College and University Business pertains to the analysis of expenditures for administrative and general purposes, libraries, plant operation and maintenance, and instruction. Bibliography of 14 items on pp. 277-278.

Russell, John Dale. The Finance of Higher Education. Rev. ed. Chicago: The University of Chicago Press, 1954. pp. 133-155, 166-168.

Discusses two methods for analyzing expenditures in colleges and universities. The first shows the percentage distribution of expenditures by function. The second involves the computation of unit costs. Explains three steps required for calculating unit costs: (1) selection of financial data to be reduced to unit terms, (2) selection of the units to be used in measuring the size of the task performed, and (3) proper relation of one to the other. Also explains uses and abuses of unit cost data. Bibliography of 39 items.

Russell, John Dale and Doi, James I. "Analysis of Institutional Expenditures." College and University Business, 19 and 20, September 1955 to August 1956, various pages.

A series of 12 articles on the problems involved in analyzing expenditures of institutions of higher education. The first article deals with certain general considerations underlying the analysis of expenditures, including a discussion of two methods commonly used for this purpose--the percentage distribution method and the unit cost method. The second article is devoted to a discussion of minimum requirements for development of normative data. Remaining articles are concerned with methods for analyzing and interpreting expenditures for administrative and general purposes, libraries, plant operation and maintenance, and instruction. Expenditure data for six New Mexico institutions are used for illustrative purposes. The five articles dealing with analysis of expenditures for instruction include a discussion of the following topics: reasons for analyzing instructional expenditures; analysis of instructional expenditures by object items, such as salaries, supplies and equipment, clerical service, etc.; distribution of faculty salaries by rank and range; scope of course offerings; semester hours of classes taught; student credit hours produced, total and per full-time-equivalent faculty member; and instructional salary cost per student credit hour produced.

Russell, John Dale; Jamrich, John X.; and Richarson, Orvin T. Instructional Programs in Michigan Institutions of Higher Education. Staff Study No. 6 of The Survey of Higher Education in Michigan. Lansing: Michigan Legislative Study Committee on Higher Education, 1958. 446 pp.

Report of a study of instructional programs in 36 institutions of higher education in Michigan, both public and private, for the academic year 1955-56. The various chapters present summary data and conclusions related to the following topics: Scope of Course Offerings, Volume of Teaching and Instructional Service to Students, Instructional Staff, Class Size, Instructional Productivity, and Instructional Salary Expenditure per Student-Credit-Hour. Appendix A and Appendix B contain detailed statistics for each institution classified by subject-area and by instructional level. Appendix C contains forms and instructions used to collect basic data from the institutions.

Scheps, Clarence. *Accounting for Colleges and Universities*. Baton Rouge: Louisiana State University Press, 1949. pp. 292-305.

Discusses the advantages and disadvantages of data showing unit costs of instruction. Outlines procedures for calculating direct costs of instruction and total costs of instruction per student-credit-hour by college and department. Sample forms for gathering basic data and allocating institutional overhead are presented and explained.

Scheps, Clarence. "Systematic Financial Analysis and Budgetary Planning as Aids in the Attainment of College and University Purposes." In Smith, G. Kerry (ed.) *Current Issues in Higher Education*, 1961: *Goals for Higher Education in a Decade of Decision*. Washington: Association for Higher Education, National Education Association, 1961. pp. 185-188.

Discusses the need for systematic financial analysis in colleges and universities, the meaning of this term, and areas within an institution where such analysis may be useful. Says the greatest need is in the area of instruction. Outlines five kinds of studies that may be of value in analyzing instructional costs.

Technical Committee on Costs of Higher Education in California. *A Report on the Costs of Higher Education in California: 1960-1975.* Berkeley: Office of the President, University of California 1960. 124 pp.

Prepared for the Liaison Committee of the State Board of Education and The Regents of the University of California. Divided into five sections: Purposes, Background, and Explanation of the Study; Historical Trends of Expenditures for Higher Education in California; Analysis of Operating Costs, 1957-1958; The Cost of Establishing New Institutions of Higher Education and Expanding Existing Ones; and The Projected Costs of Higher Education in California through 1975. An appendix contains a summary of a report on estimated library costs in California institutions of higher education. Selected bibliography of 14 items.

Toews, Emil O. "Council Is Making Cost and Statistical Analysis Study of Public Higher Education." *California Education*, I, November 1963, 23-24.

Says the Coordinating Council for Higher Education in California is making a cost study for 1963-64. Discusses briefly the authorization and general purpose of the study, intended uses of study data, and three cost area to be studied--

administration and general, instruction and research, and physical plant. Unit cost measures mentioned for the instruction and research phase are (1) teaching salary expenditure per student-credit-hour, per student-class-hour, and per full-time-equivalent teaching staff; and (2) total teaching expenditure per student-credit-hour, per student-class hour, and per full-time-equivalent staff.

Tyndall, D. Gordon. "Budgetary Implications of Faculty Load Studies." In Lins, L. Joseph (ed.). The Role of Institutional Research in Planning. Madison: Office of Institutional Studies, The University of Wisconsin, 1963. pp. 141-145.

Discusses the problem of allocating state funds among the nine campuses of the University of California and the importance of having some objective measure of need. Says: "It has seemed to us that one measure, perhaps the only practical and reasonable measure of need, is cost; not, of course, actual cost or projected cost based on program plans designed to provide the best in education regardless of cost, but some normative or standard cost which reflects the impact of those underlying variables which are at work in this industry which we call higher education." Lists four such variables and explains efforts to develop standards or norms which take them into consideration.

Tyndall, D. Gordon and Barnes, Grant A. "Unit Costs of Instruction in Higher Education." The Journal of Experimental Education, 31, December 1962, 114-118.

Contains a brief discussion of the nature and purposes of unit cost studies. A preference for limiting data to instructional salary costs per student credit hour is indicated. Attention is directed to two major questions that arise in computing unit costs: How much of the staff member's time and salary should be allocated to teaching? And how should this part of his time and salary be split among the several teaching assignments he may have? These two questions are then answered in light of the procedures used in a study at the University of California. Workload and cost data are derived from three basic calculations: "weekly teaching hours" for faculty time; "weekly student hours" for student time; and "semester hourly rate" for salary cost. Specific measures obtained from these calculations are listed and explained briefly.

Tyrrell, Philip H. "Project 'Reward': A Program of Institutional Research to Increase Instructional Productivity." *The Educational Record*, 42, July 1961, 212-220.

Describes the nature of the project, specific areas of project activity, and some sample results. One area of activity is the processing of data, by department, showing unit costs of instruction based on the student credit hour, student contact hour, and instructor contact hour. Says the data have become "a means of measuring, in terms of cost, the rsults of instructional experimentation. . . in class size and in the use of closed-circuit television." Other areas of activity included in the project are the development of multi-media instructional methods and materials, consultation with faculty, and dissemination of information.

University of Montana System of Higher Education. *Master Plan Study: Status Report*. Helena, Montana: Office of the Executive Secretary, State Capitol, Room 139, October 8, 1962. pp. 51-53.

Contains summary data from a study of unit costs for the year 1960-61. Data are shown for each institution in the system, by level of instruction, and by type of expenditure. The unit of measurement is the "student credit hour registered for."

Walker, Ernest W. "To Measure Operating Efficiency." *College and University Business*, 29, August, 1960, 24-29.

Describes a method of cost analysis which is considered to be a refinement of the unit cost method: "Whereas the cost method of analysis determines the cost of a unit of service, the proposed method measures the efficiency of expenditures as they are transferred into productive units; in other words, this method determines the turnover rate of direct instructional expenditures, indirect instructional expenditures, and permanent plant investment." Turnover rates are determined by dividing semester-credit-hour figures by corresponding expenditure figures. Presents data for 10 colleges and universities for 1954, 1955, and 1956 to show the results of applying this method. Explains causes of poor turnover rates.

Williams, Robert L. "Instructional Cost Studies in Perspective." *College and University Business*, 26, March 1959, 28-29.

Discusses 11 generalizations "that have emerged from cost studies at the University of Michigan in the last 25 years."

Wilson, Logan. "Analyzing and Evaluating Costs in Higher Education." *The Educational Record*, 42, April 1961, 99-105.

A general discussion of the need for analyzing and evaluating costs in higher education, progress in developing and utilizing standardized classifications for cost data, advantages and disadvantages of the two basic procedures commonly employed in cost measurement (the percentage distribution method and the unit cost method), and the uses and abuses of cost data in general.

Young, Harding B. "Certain Cost Concepts." Journal of Higher Education, 29, February 1958, 89-94, 116.

Says a thorough knowledge of costs and expenses is necessary for development of adequate standards in budget preparation. Distinguishes between the words "cost" and "expense." Defines and discusses the following types of costs: operating, capital, book, ignored, future, past, fixed variable, semi-variable, escapable, unavoidable, direct, indirect, and incremental. Gives several examples based on interviews with college administrators to show how cost data can be useful in small colleges.

II. Cost Analysis in Higher Education--New Technology

Carpenter, C. R. "Closed-Circuit TV for Resident Teaching." College and University Business, 24, February 1958, 17.

Mentions the need for colleges and universities to increase the "efficiency, productivity and economy" of their instructional programs. Says television systems offer highly efficient means for distributing and presenting information or instruction. Indicates installation costs for three levels of television systems and estimates that total operating costs for a "professional" system at $35,000 a year. Concludes that the use of closed-circuit television, although costly, may not be prohibitively expensive provided the system chosen is operated efficiently.

Carpenter, C. R. "...That's Teaching by TV." College and University Business, 24, March 1958, 45-47.

States two basic concepts underlying the use of closed-circuit television at Pennsylvania State University since the initiation of the project sponsored by the Fund for the Advancement of Education. Describes four general problem areas in which research has been conducted there and gives general findings and results for each area. The four areas are comparative effectiveness, appropriateness, acceptability, and feasibility or practicability. Says that "as yet, we have no thorough and systematic cost analysis of the project" but notes a few facts about reductions in the cost of teaching psychology and air science.

Carpenter, C. R. and Greenhill, L. P. "Closed Circuit TV is One Answer." College and University Business, 20, February 1956, 23-28.

The purpose of the article, according to the authors, is to report on the first phase of the Penn State Instructional Television Project, a project sponsored by the Fund for the Advancement of Education. Specific objectives and relevant findings of the first phase, which was completed in June 1955, are listed and discussed. In general, project activities were related to questions concerning the relative effectiveness, acceptability, feasibility, and appropriateness of closed circuit TV for residential instruction. With regard to feasibility, the authors state that "the first phase of the Penn State Project has not provided sufficient facts on which to base analyses of all costs" but that "the extended project during the academic year 1955-56 will provide fairly adequate information for making cost estimates." It is also stated that the following items must be included in analyses of costs: (1) equipment costs spread over a five-year antiquation period, (2) cost of installation, (3) expendable supplies and parts, and (4) operating costs.

Carpenter, C. R. and Greenhill, L. P. *Instructional Television Research, Project Number One, An Investigation of Closed-Circuit Television for Teaching University Courses*. University Park: The Pennsylvania State University, July 31, 1955, p. 69.

> Results are presented from a case study of the net cost of instruction for a course in General Psychology. Unit costs for conventional methods of teaching the course are compared with unit costs when closed-circuit television is used. Figures show net instructional salary cost per student-credit-unit. Several implications of the cost data are listed. It is pointed out that the analyses are of necessity very tentative.

Carpenter, C. R. and Greenhill, L. P. *Instructional Television Research, Report Number Two, An Investigation of Closed-Circuit Television for Teaching University Courses*. University Park: The Pennsylvania State University, Spring 1958, pp. 101-106.

> Four sections deal with the cost of teaching by closed-circuit television. In the first section, the need for cost data is discussed and factors that determine instructional costs and productivity are listed. The second section contains an analysis of operating costs for the television system used in the project. In the third section, the comparative costs of teaching four courses by conventional procedures and by closed-circuit television are presented and discussed. Data are based on the "net cost of instruction," which is limited to salaries and wages of instructors and their assistants plus operating costs of the television system. Figures are computed per student-credit-unit. Estimated costs of teaching various numbers of students are illustrated for both conventional and televised instruction. The break-even point is about 200 students. The fourth section includes some generalizations and policy suggestions concerning costs of instruction.

Cumming, William Kenneth. "The 'Teleclass' Is Stephens' Contribution." *College and University Business*, 20, April 1956, 28-32.

> Explains the use of a closed-circuit TV system for an experimental "teleclass" at Stephens College, Columbia, Missouri. The project received financial support from the Fund for the Advancement of Education and R.C.A. Describes the physical arrangement of the TV installation and says "video costs for studio equipment, coaxial cables and receivers amounted to about $32,000, including installation costs.

Erickson, Clifford G. and Chausow, Hymen M. *Chicago's TV College: Final Report of a Three Year Experiment of the Chicago City Junior College in Offering College Courses for Credit Via Open Circuit Television*. Chicago: Chicago City Junior College, August 1960. pp. 43-46.

Unit costs of television instruction and conventional instruction are compared. The basic measure is direct instructional cost per full-time-equivalent student. Averages are shown for each of the three years covered by the study and for two types of courses. Break-even points for televised instruction are estimated.

Ferry, Frederick C., Jr. "Language Teaching Today Calls for a Laboratory." College and University Business, 21, July 1956, 40-42.

Explains some of the decisions that had to be made in constructing a language laboratory at Bradford Junior College in Bradford, Massachusetts. Gives an illustration of the floor plan, describes some of the equipment, and lists installation costs.

Freese, Gordon P. "Exploring the Possibilities of Teaching by Closed-Circuit TV." College and University Business, 24, February 1958, 24-26.

A general description of the closed-circuit TV system used at Stephens College, Columbia, Missouri, for an experiment conducted under a grant from the Fund for the Advancement of Education and with the assistance of Radio Corporation of America. Says that "at the outset, we were concerned with the cost of the system and the value to be received from it." Lists several potentialities of closed-circuit television for instructional purposes.

Greenhill, Leslie P. "The Economics of Instructional Television." Paper presented at The Fourth Armed Forces Television Conference, Lowry Air Force Base, Denver, Colorado, October 23-25, 1963. 12 pp.

Discusses briefly the four classes of criteria used in gathering evidence for research on new instructional methods at Penn State University. The four are relative effectiveness, appropriateness, acceptability, and feasibility. Describes the method used in a study of the costs of televised instruction as compared to the costs of conventional instruction in four well-established television courses at that institution. Presents and discusses figures showing total investment in the television system, operational costs of the system, and comparative costs of televised and conventional instruction for each of the four departments. Includes data on costs of instruction per student-credit-unit. Considers the implication of such studies for the public schools and military services.

Greenhill, Leslie P. "Research in Televised Instruction at the Pennsylvania State University." In Adams, John C.; Carpenter, C. R.; and Smith, Dorothy R. (eds.). College Teaching by Television.

Washington: American Council on Education, 1958. pp. 74-83.

Discusses findings of studies on the use of television at Penn State University under four headings: comparative effectiveness, appropriateness, acceptability, and feasibility. With regard to feasibility, says that "during the current year we are putting much emphasis on studies of the cost of televised instruction in comparison with regular instruction" and that "with less than two hundred students, televised instruction is more expensive than the traditional method."

Greenhill, Leslie P. "What Are the Pros and Cons of Teaching by Television?" Current Issues in Higher Education, 1958. Washington: Association for Higher Education, National Education Association, 1958. pp. 233-236.

Answers four questions about the use of closed-circuit television for university teaching on the basis of studies at Pennsylvania State University. The four questions are: How effective is televised instruction as compared to direct face-to-face teaching? Can the quality of university teaching be improved through the use of television? How acceptable is televised instruction to students and faculty? Is television instruction economically feasible? Concerning the last of these questions, the author presents some of the results of a cost analysis for the preceding year and concludes that "the savings described above would almost pay for the cost of the TV system in one year." Also states that "cost analyses are being repeated on a more extensive scale during the current academic year."

Hocking, Elton. "The Language Laboratory." College and University Business, 22, June 1957, 22-25.

Presents and discusses data showing costs related to the purchase, installation, and maintenance of language laboratories at Purdue University.

Lepore, Albert R. and Wilson, Jack D. Instructional Television Research, Project Number Two, An Experimental Study of College Instruction Using Broadcast Television. San Francisco: San Francisco State College, 1958. 77 pp.

Report on a study sponsored by the Fund for the Advancement of Education. The general purpose was to explore the offering of courses in general education to regularly enrolled college students using open-circuit instructional television. Specific purposes were to estimate the relative efficacy of three media of instruction (television at home, television on campus, and regular campus instruction), to estimate the relative efficacy of four supplementary avenues of instruction, to get evidence on the feasibility of successfully teaching college courses to high school students, to explore attitudes toward the teaching-learning process, and to describe the administration, production, and cost of open-circuit instructional television in an experimental setting. Results pertaining to the analysis of costs are presented and discussed on pp. 52-57. Three statements are drawn from the cost data: (1) it is economically feasible to offer lecture-discussion courses by television if enrollments of about 950 students are attainable; (2) more expensive courses become feasible when a minimum of 1,440 students are available; and (3) the cost of televised instruction, after initial costs have been met, may be reduced for subsequent semesters and break-even points may be lowered.

MacNeille, Holbrook M. "What are Some of the Administrative Problems Posed by Television as an Educational Device?" *Current Issues in Higher Education, 1958*. Washington: Association for Higher Education, National Education Association, 1958. pp. 224-226.

Refers to the problem of finding a method of instruction of good quality which is relatively insensitive to the number of students and says that "in the mathematics department at Washington University, television is proving helpful in finding a solution." Explains briefly the many uses of television in the department and some things that have been learned as a result. Includes some general remarks about costs and states that "the great advantage of television is that the marginal cost of increased enrollment, measured in dollars, staff, or facilities, is relatively small."

Macomber, F. G. and Siegel, Laurence. "A Study in Large-Group Teaching Procedures." *The Educational Record*, 38, July 1957, 220-229.

A description of the purposes, areas of investigation, and findings of the Miami University Experimental Study in Instructional Procedures, a study financed by the Fund for the Advancement of Education. The primary purposes of the study are "to determine the effectiveness of large-group instructional procedures, including the use of television, for course instruction, and to find ways and means of improving upon present large-group practices in college teaching." Areas of investigation relate to achievement of students, student attitudes about the course and instructor, and student attitudes about television and other large-class costruction. Findings and tentative conclusions are summarized for each area. Following this, the authors state that "experiences of the study have served to focus attention on several problems of major concern." Problems discussed are inadequacy of facilities, in-service education for teachers, teaching loads, and cost. In discussing the cost problem, it is noted that rough estimates of cost at Miami University indicate that a course must enroll six or seven sections of about 30 to 35 students each to make the per-pupil cost no greater than if each section were taught in the conventional manner.

McIntyre, Charles J. and Paden, Donald W. "Economic Considerations In Televised Instruction." The Journal of Higher Education, 33, June 1962, 319-323.

A discussion of the opportunities afforded by instructional television, some cost estimates for courses at the University of Illinois, and problems of transition from conventional methods of instruction to televised instruction which may affect the economic interests of the professor. The cost estimates are based on data showing actual costs of teaching certain high-enrollment courses under conventional methods of instruction and certain assumptions about what it would cost to teach these courses with televised instruction. Some of the results of cost studies at Pennsylvania State University are also presented for comparative purposes.

Paden, Donald W. "The Teaching of Economics Via Television at the College Level," in Televised College Courses, New York: Fund for the Advancement of Education, 1962. pp. 65-88.

An analysis of advantages and disadvantages of televised instruction, and estimates of comparative costs for varying volume levels, under various assumptions as to equipment life, preparation costs, etc.

Rubin, Harold. "Interviews by Long-Distance Stimulate Learning Rate." College and University Business, 30, February 1961, 32-35.

Describes the costs of interviewing specialists by long-distance telephone in certain experimental classes at Stephens College, Columbia, Missouri, during the academic year 1959-60. Concludes that interviews of this type are not only economically feasible but relatively inexpensive.

Seibert, W. F. "Comparative Costs for Televised and Conventional Instruction." Audio-Visual Communication Review, 7, Fall 1959, 254-263.

Says "it seems that sufficient experience with televised formal instruction has accumulated to serve as a basis for some preliminary instructional cost estimates" and "it will be the purpose of this paper to supply several such estimates and to compare these with corresponding estimates for conventional instruction." The estimates are designed to be most applicable to situations involving relatively large numbers of students and a I to I correspondence between student-instructor weekly contact hours and student credit hours. The basic unit of cost is "direct instructional cost per student per semester hour of credit." For conventional instruction, the only direct cost factor used for the estimates is the salary of the instructor. For televised instruction, four cost factors are considered: instructor salary; instructor "release time;" cost of establishing, maintaining, and operating the television facilities; and salaries of graduate assistants used to supervise classroom groups and to aid the instructor. Assumptions underlying the estimates are listed. Two of these are that instructors normally carry a teaching load equivalent to 12 class hours per week and that a class consists of 30 students. Basic unit cost estimates are plotted for three levels of instructor salaries ($6,000, $7,500, and $9,000) and two levels of television costs ($20 per hour of instruction and $30 per hour of instruction), with the number of classes ranging from 2 to 14. Computational procedures are explained in two examples. Significant relationships are discussed. In conclusion, it is pointed out that the possibility of presenting filmed or video-tape lessons on television was ignored.

Shepherd, William G. "Operations Research in Education," Management Science, Vol. 11, No. 4, February 65, pp. C13-C19.

Proposes application of methodology of OR to administration of public schools.

Teaching by Television. A Report from the Ford Foundation and The Fund for the Advancement of Education. New York: The Ford Foundation, 1959, pp. 25-28.

A discussion of the feasibility of televised instruction. Presents the results of a study of four courses at Penn State University during 1956-57 which showed savings of $38,000 in one year through the use of television as compared with the usual ways of teaching these courses, a reduction in average cost per student-credit-unit from $9.48 for conventional teaching to $5.44 for televised instruction, and a break-even point for television when 200 students were enrolled in a course. Reference is also made to a study at Miami University where it was found that televised instruction can break even when 220 students are taught simultaneously in a given course.

Walker, Warren S. "Low Cost Language Laboratory, Blackburn College." College and University Business, 26, May 1959, 38-41.

Describes a low-cost language laboratory installed at Blackburn College, Carlinville, Illinois. Stresses the simplicity of operation and maintenance. Provides a floor plan of the laboratory and an itemized list of equipment costs.

III. Cost and Budgetary Analysis--General

Backer, Morten and Jacobsen, Lyle E. Cost Accounting: A Managerial Approach. New York: McGraw-Hill, 1964. 678 pp.

This cost accounting textbook emphasizes the control aspects of accounting rather than the financial reporting aspects. Sections are included on Performance Evaluation, Variable Costing, Return on Capital, Use of Costs in Pricing Decisions, Costs for Investment Decisions, and Breakeven Analysis. The context is industrial.

Chamberlain, Neil W. The Firm: Micro-Economic Planning and Action. New York: McGraw-Hill, 1962, 425 pp.

This book is about the way businesses perform the budgeting (i.e., planning) job, written by a prominent academic economist. His observations are based on an extensive survey of the literature of corporate budgeting, accounting, and financial management. The book's distinction from other books on Budgeting is that it is written by an "outsider" rather than a participant in the budgeting process, with the accompanying detachment that would thereby be expected.

Churchill, Neil. "Linear Algebra and Cost Allocations: Some Examples," Accounting Review, XXXIX, No. 4, October 1964, pp. 894-904.

Shows use of matrix algebra for allocation of service department costs.

Crowningshield, Gerald R. Cost Accounting: Principles and Managerial Applications. Boston: Houghton Mifflin Company, 1962. 696 pp.

Designed "to serve as a basic text in cost accounting for courses in which the instructor wishes to place the major emphasis on the uses, rather than on the accumulation, of accounting data." Divided into three parts. Part One, Basic Principles and Procedures, contains a brief survey of two basic cost accounting systems (job order and process); a discussion of some of the problems that arise in connection with costing and control of the three major cost components (materials, labor, and indirect manufacturing costs), and a description of standard costs. Part Two, Managerial Uses of Accounting Data, includes chapters on analyzing cost behavior, distribution cost analysis, break-even analysis, cost-profit-volume analysis, profit and loss analysis, decision-making costs, cash budgeting, capital budgeting, and direct costing. Part Three, Advanced Problems in Process Costing, is directed toward the accounting major who is preparing for the C.P.A. examination.

Dearden, John. *Cost and Budget Analysis*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1962. 202 pp.

This book is concerned with "the financial information that management needs for making short-term operating decision." It covers cost accounting, cost analysis, and budgetary control. Chapter I contains a description of the general characteristics of three basic types of accounting systems--job order, process, and standard. Chapters II to IV deal with techniques and procedures related to the analysis of variances between actual and standard costs, allocation of indirect costs to products or departments, and determination of costs applicable to joint products or by-products. Chapter V focuses on the advantages and disadvantages of direct costing as well as various measures of the volume of production to be used in computing unit costs. Chapters VI to VIII discuss budgetary control in connection with operating budgets, programmed budgets, and profit budgets. Chapters IX to XI cover differential cost analysis, profit-volume analysis, special control techniques, and procedures for evaluating a cost accounting and budgetary control system.

Fiske, Wyman P. and Beckett, John A. (eds.). *Industrial Accounting Handbook*. Englewood Cliffs, N. J.: Prentice-Hall, 1954. 1072 pp.

Although this handbook is designed primarily as a reference for accountants in manufacturing industry, certain sections of it are applicable to cost analysis and control in higher education. Among these are Chapter 10, The Design and Administration of Business Systems, and Chapter 15, Control of Operations and Investment. Portions of applicable material are found in chapters on Overhead Cost, Administrative Cost, Budgeting, and Cost Reports.

Haseman, Wilber C. *Management Uses of Accounting*. Boston: Allyn & Bacon, 1963. 785 pp.

Haseman has reconstructed the material of a typical basic accounting textbook in a form whereby accounting records, procedures, and techniques are studied from the approach of their utility to enterprise managers. In addition to the material on traditional accounting statements and reports, chapters are included on Accounting Systems, Internal Control, Cost Accounting, Breakeven Analysis, Budgetary Planning, and Budgetary Control.

Manes, Rene Pierre, "Using Computers to Improve Distribution of Service Costs," *Journal of Accountancy*, March 1963, Vol. 115, No. 3, pp. 57-60.

Shows how to use matrix algebra to allocate service department costs.

McDonough, Adrian M. Information Economics and Management Systems. New York: McGraw-Hill, 1963. 321 pp.

The particular cost analysis consideration in this book is the attempt to provide criteria for measuring the cost of information in organizations versus the value of information for its use in managing activities in the organization. The author draws upon communication theory and value theory in economics to work toward systematic classification of management information and systematic structuring of information channels for management. The development here can be said to be still exploratory.

Nickerson, Clarence B. Managerial Cost Accounting and Analysis: Text, Problems, and Cases. Second Edition. New York: McGraw-Hill Book Company, Inc., 1962. 644 pp.

The central theme of this book is "the managerial use of cost accounting." It contains thirteen chapters covering the following topics: The Field of Cost Accounting, Inventory Valuation and Profit Determination, Methods of Cost Accumulation, Joint Product and By-Product Costing, Standard Costs, Variance Analysis, Special Problems of Factory Burden, Cost-Price-Volume Relationships, Budgetary Control, Budgeting and Control of Administration and Distribution Costs, Financial Budgeting, Cost-Price Relationships, and Problems of Alternative Choice. Each chapter begins with text material followed by problems, cases, or both. Problems consist of exercises and assumed situations which are fictional in character. Cases are descriptions of actual business situations.

Shillinglaw, Gordon. Cost Accounting: Analysis and Control. Homewood: R. D. Irwin, Inc., 1961. 779 pp.

This textbook in "internal managerial accounting" looks at accounting activities, records, and processes from the viewpoint of the corporate management user of accounting data. In common with most cost accounting books, it has a manufacturing context. However, there are chapters on Budgetary Planning and Control, Patterns of Business Costs, Control of Non-Manufacturing Costs, Qualitative Elements in Decision Making, Profit-Volume Analysis, Internal Transfer Pricing, plus chapters on the usual cost accounting subjects.

Spencer, Milton and Siegelman, Louis. Managerial Economics. Homewood: R. D. Irwin, Inc., 1959. 454 pp.

This textbook designed for graduate students in Economics and Business contains, in Chapter 7, an excellent treatise on the nature of costs, from both Accounting and Economic viewpoints.

Thomas, William E., Jr. (ed.). *Readings in Cost Accounting, Budgeting, and Control*. Sponsored by and Published under the Auspices of the American Accounting Association. Cincinnati: South-Western Publishing Co., 1955. 785 pp.

A collection of articles on cost accounting, budgeting, and control designed "to supplement the textbooks by presenting the various, and sometimes contradictory, views of leading practitioners and teachers, and to provide an intellectual challenge to the student." Divided into four sections: Background and Theory, Problem Areas of Accounting for Product and Period Costs, Problem Areas of Planning and Control, and Reports for Management. Includes bibliographies for the last three sections.

Welsch, Glenn A. *Budgeting: Profit Planning and Control*. Revised Edition. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1964. 600 pp.

As the author says in the preface, this book was written "not for the expert, but for those with a limited knowledge of the subject who seek to know more." Emphasis is given "to a practical and understandable application of profit planning and control to the real problems of the executive." Part I presents a general discussion of budgeting, its relation to the basic functions of management, and fundamental principles underlying the budget process. Parts II and III contain a detailed description of the components of a comprehensive budget program. The five major components are the long-range plan, the annual profit plan, variable expense budgets, supplementary statistics, and budget reports to management. Part IV covers three topics: (1) the inter-relationships between a comprehensive budget program, a standard cost system, and a direct cost system; (2) budgeting for nonmanufacturing concerns and nonprofit organizations; and (3) problems in the adaptation and use of budget procedures.

Williams, Thomas, and Griffin, Charles, "Matrix Theory and Cost Allocation," *Accounting Review*, XXXIX, No. 3, July 1964, pp. 671-678.

Shows how to use matrix algebra to allocate service department costs.